Monroe County and Incorporated Municipalities

Key West, Marathon, Key Colony Beach, Layton, and Islamorada Village of Islands

Local Mitigation Strategy

2005 Revision

PUBLIC REVIEW DRAFT June 2005

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[XX this TOC is temporary; page numbers will be assigned

Resolution of Adoption

[XX this page will show thumbnails of all resolutions (each jurisdiction will have its own); full-size copies of the resolutions will be included in Appendix B

Chapter 1: Introduction

Monroe County, Florida, and its incorporated municipalities of the Village of Islamorada, City of Layton, City of Key Colony Beach, City of Marathon, and the City of Key West, undertook development of this *Local Mitigation Strategy* (LMS) because of its awareness that natural and man-made hazards, especially hurricane and flooding hazards, may affect many people and property. The LMS is a requirement associated with receipt of certain federal mitigation grant program funds administered by the Florida Department of Community Affairs and the Federal Emergency Management Agency.

1.1 Authority

The Board of County Commissioners directed the Office of Emergency Management (OEM) to coordinate with other appropriate departments and agencies, and the cities of Key West, Marathon, Key Colony Beach, Layton, and Islamorada, to facilitate the development of the LMS in conformance with state and federal guidelines.

The LMS revision was prepared to comply with the Florida Department of Community Affairs' requirements (Florida Administrative Code Chapter 9G-22) and the provisions of the federal Hazard Mitigation and Pre-Disaster Mitigation Programs (44 CFR Parts 201 and 206), and the Flood Mitigation Assistance Program (44 CFR 78.6). Communities and the non-profit organizations located in them must participate in a mitigation planning process that results in an adopted strategy that is approved by FEMA in order to qualify for certain federal mitigation funds.

Florida Administrative Code Chapter 9G-22 sets forth the composition and responsibilities of the LMS Working Groups. In particular, Work Groups are to develop and revise the LMS, set the order of priority of projects submitted for funding, and submit an annual report. The minimum contents of the LMS are specified and include a number of provisions that are not explicitly set forth in federal requirements.

1.2 Work Group Membership

The LMS Work Group was established in 1998 pursuant to authorization by the Monroe County Board of County Commissioners (BOCC). It has met periodically since then, convening on February 15, 2005 for the specific purpose of initiating the revision of the Local Mitigation Strategy (LMS).

The Work Group includes representatives from all incorporated municipalities in Monroe County. Prior to the 1999 LMS, Work Group Agreements were established between

Monroe County and the municipalities. The City of Marathon joined upon its incorporation in late 1999.

Representatives from following are designated members of the Work Group:

- Monroe County, Emergency Management (Chairman)
- Monroe County, Growth Management
- Monroe County, Historic Florida Keys Foundation
- Monroe County, Health Department
- Monroe County School System and Public Board of Education
- Monroe County, Grants Coordinator
- Monroe County Extension Service
- City of Layton, City Administrator
- Village of Islamorada, Fire Chief
- City of Key Colony Beach, Building Official
- City of Key West, Assistant Engineer
- City of Marathon, City Planner
- City Electric
- FL Keys Electric Cooperative
- FL Keys Aqueduct Authority

The following were notified throughout the planning process and invited to review and comment on the LMS before it was finalized: [XX *this list will be double checked and updated after the actual notifications are sent*]

- Florida Department of Community Affairs
- Rotary Club
- Salvation Army
- Florida Keys Employment and Training Council
- Paradise Interfaith Network
- Innerspace Dive/FL Seacamp
- Monroe County Association for Retarded Citizen's
- American Red Cross
- Marathon Chamber of Commerce
- Century 21
- FL Keys Citizens Coalition

- State Representative Ken Sorensen, District 120
- Office of Congressional Representative Lleana Ros-Legtinen, 18th District

1.3 Acknowledgments

The revised LMS was supported by a planning grant administered by the Florida Department of Community Affairs using funds provided by the Federal Emergency Management Agency.

The revised 2005 LMS was prepared with the support of RCQuinn Consulting, Inc., Annapolis, MD. The 1999 LMS was prepared with the support of Janice Drewing Consulting, Inc. of Plantation Key, Florida.

1.4 Key Terms

For the most part, terms used in the Plan have the meanings that are commonly associated with them:

- **Disaster** means the occurrence of widespread or severe damage, injury, loss of life or property, or such severe economic or social disruption that supplemental disaster relief assistance is necessary for the affected political jurisdiction(s) to recover and to alleviate the damage, loss, hardship, or suffering caused thereby.
- **Floodplain:** See "Flood Hazard Area".
- **Hazard** is defined as the natural or technological phenomenon, event, or physical condition that has the potential to cause property damage, infrastructure damage, other physical losses, and injuries and fatalities.
- **Mitigation** is defined as actions taken to reduce or eliminate the long-term risk to life and property from hazards. Mitigation actions are intended to reduce the need for emergency response – as opposed to improving the ability to respond.
- **National Flood Insurance Program (NFIP),** located within the U.S. Department of Homeland Security, Emergency Preparedness and Response Directorate (FEMA), is charged with preparing Flood Insurance Rate Maps, developing regulations to guide development, and providing insurance for flood damage.
- **Risk** is defined as the potential losses associated with a hazard. Ideally, risk is defined in terms of expected probability and frequency of the hazard occurring, people and property exposed, and potential consequences.
- **Flood Hazard Area** or **Floodplain** is the area adjoining a river, stream, shoreline, or other body of water that is subject to partial or complete inundation. The area predicted to flood during the 1% annual chance flood is commonly called the "100-year" flood.

1.5 Acronyms

The following acronyms are used in the document:

- **CRS** – Community Rating System (NFIP)
- **DCA** – Florida Department of Community Affairs
- **FEMA** – U.S. Department of Homeland Security, Emergency Preparedness and Response Directorate (FEMA)
- **FIRM** – Flood Insurance Rate Map
- **FMA** – Flood Mitigation Assistance (FEMA)
- **GIS** – Geographic Information System
- **HMGP** – Hazard Mitigation Grant Program (FEMA)
- **LMS** – Local Mitigation Strategy
- **NFIP** – National Flood Insurance Program (FEMA)
- **PDM** – Pre-Disaster Mitigation grant program
- **ROGO** – Rate of Growth Ordinance
- **TAOS** – The Arbiter of Storms

1.6 References

American Society of Civil Engineers. 2002. *Minimum Design Loads for Buildings and Other Structures* (SEI/ASCE 7-02). Reston, VA.

Federal Emergency Management Agency. Various Panel Dates. *Flood Insurance Study and Flood Insurance Rate Maps* for Monroe County, Key West, Key Colony Beach, Layton, Islamorada, and Marathon, Washington, DC. [Available for public review at planning and/or permit offices of each jurisdiction.]

Federal Emergency Management Agency. 1997. *Multi-Hazard Mitigation and Risk Assessment.* Washington, DC. Online at http://www.fema.gov/mit/tsd/ft_mhira.htm.

Florida Department of Community Affairs. Florida Hazardous Weather, a Preparedness Guide.

Florida Sea Grant Program, University of Florida. July 1994. The Effect of hurricane Andrew on Monroe County Businesses: Negative Economic Effects and Assistance Sought.

Monroe County, Florida. Year 2010 Comprehensive Plan: Policy Document.

Monroe County, Florida. Year 2010 Comprehensive Plan: Technical Document.

Monroe County, Florida. Comprehensive Emergency Management Plan (Rev. #6, 2003).

Monroe County Cooperative Extension Service. August 1994. The Effect of Hurricane Andrew on Monroe County's Natural Resources and Its Dependent Industries.

Chapter 2: The Planning Area

The planning area includes Monroe County and the incorporated municipalities of the Village of Islamorada, City of Layton, City of Key Colony Beach, the City of Marathon, and the City of Key West. The Monroe County *Year 2010 Comprehensive Plan* contains extensive narrative to describe the County and its policies. The following brief summaries are, in large part, taken from that document.

2.1 Geography & Planning Area

Monroe County is located at the southernmost tip of the State of Florida. The Florida Keys are situated in a precarious physical location between the Gulf of Mexico and the Atlantic Ocean dangling from the mainland like "hurricane bait." The Keys consist of an archipelago that sweeps for almost 150 miles in a southwesterly direction from southeastern Miami-Dade County. The mainland portion of the County is bordered by Collier County to the north and Miami-Dade County to the east (See Figure 2-1).

[XX *Insert Figure 2.1 Location Map*

The total area of Monroe County is approximately 1.2 million acres (about 1,875 square miles). Large portions are submerged lands associated with parks and preserves that are under the jurisdiction of the federal and state governments. The total land area is approximately 885 square miles, of which about 102 square miles are in the Keys (including unincorporated and incorporated municipalities). The entire mainland portion is within the Everglades National Park or the Big Cypress National Preserve and is virtually uninhabited.

The County's *Year 2010 Comprehensive Plan* focuses primarily on the Florida Keys – which is the same planning area for the Local Mitigation Strategy. The Florida Keys are typically long, narrow, and low-lying islands. The average elevations of the various larger islands range from four to seven feet above mean sea level. Only one small area in the City of Key West referred to as Solares Hill rises to 16 feet above mean sea level. Other relative high areas are several coral ridges in Key Largo are near Mile-Marker 106.

2.2 Population

The estimated projected population of Monroe County and the incorporated municipalities for 2005, including incorporated municipalities, is just over 88,000 (see Table 2-1). The permanent resident population is growing at about 0.6% per year. The area's population varies considerably due to seasonal residents; at peak season, the seasonal population is

estimated at 73,737. All told, the Florida Keys receives approximately 3,000,000 visitors per year.

Table 2-1. Populations Estimates

	Permanent Resident*	Seasonal	Functional (combined permanent & seasonal)
Monroe County (unincorp)	40,816	35,518	76,334
Islamadora	7,897	8,735	16,632
Layton	221	169	390
Key Colony Beach	1,160	1,723	2,883
Key West	26,731	17,354	44,085
Marathon	11,480	10,238	21,718
Total	88,305	73,737	162,042

*The projected permanent population is based on a methodology created by The Division of Planning and Environmental Resources, and is based on 1990 Census data

Approximately 15% of the total population is over the age of 65. As of mid-2005, the Special Needs Registry includes approximately 363 people enrolled in the Special Needs Hurricane Evacuation Program due to age, medical condition, or other factors require assistance from the County to evacuate during an emergency (Table 2-2). The County has a small non-English speaking population spread throughout the Keys and a small transient worker population.

Table 2-2. Special Needs Registry (2005)

Mile Marker	Registered Special Needs
0-12	183
13-40	39
41-72	57
73-92	31
93-113	53
Total	363

2.3 Land Use & Growth Trends

Growth trends in Monroe County are regulated through the number of residential permits issued. The majority of the new residential permits issued are for permanent residential use although some permanent dwellings are used by seasonal residents.

The number of dwelling units (permanent and seasonal) which can be permitted in Monroe County has been controlled by the Rate of Growth Ordinance adopted by Monroe County in 1992 to implement portions of its Comprehensive Plan. Called ROGO, this approach was developed as a response to the inability of the road network to accommodate a large-scale hurricane evacuation in a timely fashion. A series of complex models developed during the area's first evacuation study identified an approximate number of additional dwelling units which could be permitted and which would not have a detrimental effect on the time needed to evacuate the Keys. The number of allocations for each area was based upon the supply of vacant buildable lots. The ROGO system was developed as a tool to equitably distribute the remaining number of permits available both geographically and over time.

The ROGO system distributes a pre-determined number of allocations for new residential permits on a yearly basis from July 14 of one year to July 13th of the following year. Each service area of unincorporated Monroe County and several of the incorporated areas receive allocations. The Ocean Reef area of north Key Largo is exempted from the ROGO system due to its proximity to Card Sound Road, an alternate evacuation route.

In unincorporated Monroe County, the ROGO system allowed 255 allocations for new residential units for each of the first six years. The number of allocations available was reduced by 20% (from 255 to 204) by the State of Florida Administration Commission during Year 7, based upon a lack of progress on the implementation of the Year 2010 Comprehensive Plan.

The County's annual allocation was further reduced to 158 by the incorporation of Islamorada and Marathon, which receive 22 and 24 allocations per year, respectively. This number was further reduced by the incorporation of Marathon, which received a total of 24 new residential allocations.

The current allocation of 158 is divided into 127 "market rate" and 31 "affordable" units and are distributed in unincorporated Monroe County as follows:

- 46 units in the Upper Keys service area,
- 7 units in the Middle Keys service area, and
- 74 units in the Lower Keys.

Nonresidential permitting also plays a role in land use and growth trends. Nonresidential permits include everything that is not residential, including industrial, commercial, nonprofit and public buildings, and replacement or remodeling of existing nonresidential structures.

Also included are vested and ROGO-exempt hotels, motels, campgrounds, marinas and other commercial facilities.

With very little industrial and agricultural activity in the Keys, the predominant form of nonresidential development is commercial. There are two primary types of commercial development: retail trade and services (which includes tourism-related development such as marinas and restaurants). Therefore, the impact of nonresidential development on public facilities varies significantly based on the type of commercial use.

Nonresidential and residential developments tend to fuel one another. Residential populations provide markets for nonresidential activities. Nonresidential development, in turn, helps to drive permanent and seasonal population growth by providing services and employment. Certain types of nonresidential development also concentrate the demand for public facilities within certain locations and during peak seasons.

Since residential development is constrained through the Rate of Growth Ordinance and the Permit Allocation System, it was thought that nonresidential (commercial) development should also be constrained in the interest of maintaining a balance of land uses.

At the time the Comprehensive Plan was prepared in 1991, 17.6% of the land was under residential use, while 4.6% was used for commercial development). It was determined that this balance was appropriate at the time. To assure that balance was maintained, the Comprehensive Plan proposed Policy 101.3.1. In effect, the square footage of new commercial development that may be permitted is limited to 239 square feet for each new residential permit issued. This equates to around 37,762 square feet of new commercial development per year throughout unincorporated Monroe County.

2.4 Economic Characteristics

Monroe County's economy is unique in a number of respects due to its location and geography. The area attracts both seasonal residents and short-term visitors, drawn by the amenable climate and recreational opportunities. The economy is dominated by tourism and the commercial fishing industry. The following text is based on the Comprehensive Plan (1999).

There are approximately 175 hotels and motels with a total of over 7,200 rooms, numerous rental homes, 109 Mobile Home/RV parks, 6,100 individual mobile home parcels, and over 2,800 campsites. Services, dominated by hospitality (food and lodging), is the largest

segment of the private sector, followed by retail trade. These industries account for nearly 52% of total employment, and 67% of private sector employment.

Commercial fishing represents 7% of total employment and 9% of private sector employment. A combination of economic and natural resources factors have lead to a decline in the number of commercial fishing vessels and a long-term downward trend in the total poundage of the harvest.

Two other private sector categories together account for about 15% of total employment: construction and finance/insurance/real estate.

Property Valuations*

Residential: $9.324 million
Commercial/Medical: $1.932 million
Medical: $154 million
Industrial: $203 million
Agricultural: $23 million
Education: $30 million
General Government: $68 million
Emergency Response: $15 million

Table 3.3.1*
Florida State Hazard Mitigation Plan (2004)

Public sector employment accounts for just over 20% of total employment. This category includes the federal government (and military), State and local government agencies, and utilities.

Because the tax base in Monroe County is supplemented by tourism, declines in the number of visitors after major hurricanes lead to reduced revenue associated with the Bed Tax, Sales Tax, and Infrastructure Tax. Historically, damaging storms result in significant loss of revenues.

2.5 Transportation

The transportation network in the Florida Keys is unique in that a single road forms its backbone and the sole link to the Florida mainland. U.S. Route 1, referred to as the Overseas Highway, runs for 126 miles from Florida City in Dade County to Key West in Monroe County. Maintained by the Florida Department of Transportation, for most of its length U.S. 1 is a two-lane highway with 41 bridges (combined total length of 19 miles of bridge).

U.S. 1 is a lifeline for the Keys, functioning as both highway and "Main Street." Each day it brings food, materials, and tourists from the mainland, driving the local economy.

Approximately 450 miles of roads, including 37 bridges, are maintained by the County. Card Sound Road, operated as a toll road, is an alternate to U.S. 1 in some locations. Mainland Monroe County consists primarily of government-owned parks and preserves, and consequently has few roads. The only County-maintained road is Loop Road, a 16-mile excursion off of U.S. 41 crossing the Dade and Collier County lines.

The cities of Key West, Marathon, Key Colony Beach, Layton, and Islamorada are responsible for the streets within their boundaries.

Air transportation is a viable alternative to highway travel. Monroe County's by two airports: Key West Airport and Marathon Airport, serve major commercial airlines. Four privately-owned community airports are also located in the Keys.

2.6 Critical Facilities

The LMS Work Group determined that the following distinctions are appropriate for "critical facilities," where that term includes buildings and facilities that are identified by the public entities, utilities, and non-profit organizations that own them:

- **Critical Facilities** are buildings and infrastructure that are vital to the operations and continuity of government operations necessary to perform essential security missions and services to ensure the general public health and safety in order to make daily living and working possible. Critical facilities generally should be functional within 24 to 72 hours after a declared disaster depending on the severity of the event.
- **Primary/Important Facilities** are those that should be functional within seven days after a declared disaster.
- **Secondary/Standard Facilities** are those that need not be fully functional until six months after a declared disaster.

Appendix A contains a database of public and critical facilities and certain private non-profit facilities and basic information. Figure 2-2 shows locations of those facilities that, as of mid-2005, can be plotted. Table 2-3 contains notes on selected critical facilities and Table contains notes on selected infrastructure.

[Figure 2-2 *placeholder for map(s) to show the locations of the critical facilities for which we have location data; County GIS has some layers (schools, fire, etc.)*

Table 2-3. Notes on Selected Critical Facilities

Hospitals/Nursing Homes	**Hospitals** • Florida Keys Health Systems (Depoo Hospital and Lower Florida Keys Health Center) • Marathon (Middle Keys) – Fishermen's Hospital • Tavernier (Upper Keys) – Mariner's Hospital • All hospitals must evacuate Monroe County in a storm of Category 3 or greater. **Nursing Homes** • Bayshore Manor, Key West (Monroe County owned and operated) • Key West Convalescent Center (proprietary) • Marathon Manor Nursing Home (proprietary) • Plantation Key Convalescent Center (proprietary) • All nursing homes must evacuate Monroe County in a storm of Category 3 or greater.
Schools/Shelters	**Public Schools/Hurricane Shelters** Only selected schools have been identified as suitable shelters for use in tropical storms, Category 1-2 hurricanes, and other emergency purposes. In most cases, for hurricanes of Category 3 and higher all persons must evacuate Monroe County and shelters will not be used: • Key West High School, 2100 Flagler Ave., KW • Sugarloaf Elementary School, Mile-Marker 19, Sugarloaf Key • Stanley Switlik Elementary School, Mile-Marker 48.5, Marathon • Coral Shores High School, Mile-Marker 90 Plantation Key • Key Largo School Cafetorium, Mile-Marker 105, Key Largo **Other facilities that may be used as hurricane shelters:** • Horace O'Bryant School, Key West • Harvey Government Center, Key West • Saint Justin Martyr Catholic Church, Key Largo

Table 2-4. Notes on Selected Infrastructure

Bridges • 42 bridges connect primary roadway US 1. • Two drawbridges, Jewfish Creek located at Mile-Marker 107 and Snake Creek Bridge at Mile-Marker 86, open periodically for marine traffic; drawbridge operations and possible breakdowns can interrupt traffic flow. • "Lifelines" (Linear components of critical infrastructure)
Water Lines • Primary supply pipeline on mainland in Florida City (managed by Florida Keys Aqueduct Authority) • Some distribution pipeline connected to roads and bridges. • Contingency and redundancy:

• Primary pipeline serving Upper Keys is subaqueous and does not depend on roads and bridges. • Reverse Osmosis Plant located in Marathon to serve Middle Keys. • Reverse Osmosis Plant located in Stock Island (Key West) to serve Lower Keys.
Power Lines • Electric Power supplied by Florida Keys Electric Cooperative (FKEC) Upper Keys to Marathon • Electric Power supplied by Key West City Electric System (CES) Marathon to Key West. • Majority of electric lines above ground. • No power poles located on bridges. • To prevent loss if bridges are damaged, transmission line power poles are pile-driven into the water along roads and bridges. • Subsequent to Hurricane Andrew poles re-designed to withstand serious storm conditions were installed in certain areas such as along the 18-mile stretch. Old equipment is being replaced with newer, more resilient materials.
Telephone Service • To provide redundancy, two major trunk fibers are provided from Homestead on the mainland to Key West. One is buried and the other is aerial. • Most cable lines located along underside of fixed bridges, therefore vulnerable if bridges fail. • Digging not feasible because of rock substructure. • Environmental considerations inhibit underwater installations.

2.7 Environmental & Historic Resources

2.7.1 Environmental Resources

The Florida Keys contains many valuable environmental resources. It has unique habitats, with many rare and/or endangered plant and animal species. Because of these special environmental considerations, in 1980, through legislative act, the State of Florida designated the Keys portion of unincorporated Monroe County and the incorporated municipalities as "Areas of Critical State Concern." The purpose of the program is to protect the unique environment, vegetation, and natural resources of the designated area by regulating land development and other activities regarded as detrimental to the environment. In conjunction with the designation, the legislature enacted the "Principles for Guiding Development," which are set forth in Chapter 380.0552(7). The law provides for State oversight of development and changes to land use regulations, a function carried out by the Department of Community Affairs. The Department established Field Offices in Monroe County to assist in review of development permits and related issues for compliance with the "Principles."

The Florida Department of Environmental Protection Office in Marathon submitted the following list of specific environmentally sensitive areas referred to as "Special Management Areas" (state and federal):

- Florida Keys Marine Sanctuary (comprehensive designation)
- Bahia Honda State Park
- Fort Zachary Taylor State Historic Site
- Indian Key State Historic Site
- John Pennekamp Coral Reef State Park
- Lignum Vitae Key State Botanical Site
- Long Key State Park
- Windley Key Fossil Reef State Geological Site
- Curry Hammocks State Park
- San Pedro Underwater Archaeological Preserve
- Key Deer National Wildlife Refuge
- Great White Heron National Wildlife Refuge
- Looe Key National Marine Sanctuary
- Key Largo National Marine Sanctuary
- Everglades National Park (primarily mainland Monroe)

2.7.2 Historic Resources

A significant percentage of tourism in the Keys is associated with its unique archeological, historical, and cultural heritage and many landmarks. Many sites are listed on the National Register of Historic Places and designated for protection (available at http://www.cr.nps.gov/places.htm). Many identified historic resources could experience irreversible damage from hurricanes. The Historic Florida Keys Foundation, Inc. has agreement with County to provide professional staffing for historic preservation. The County has about 330 locally- designated sites identified under Article 8 of the Monroe County Code as Archaeological, Historical, and/or Cultural Landmarks (available on the County's webpage). Key West's Historic Architect Review Commission has locally-designated about 2,300 sites (available on the City's webpage).

Despite recent hurricanes, historic resources have, for the most part, escaped significant damage. A number of significant properties have been mitigated:

- The Old Monroe County Courthouse (located at Mile Marker XX on XX Key), a state-owned building, has suffered wind damage in the past; it was retrofit with window protection using FEMA's Hazard Mitigation Grant Program funds.
- Retrofit the steeple of the Old Key West City Hall (XX address) with motorized hurricane shutters was funded by FEMA.

Chapter 3: Mitigation Planning

3.1 Introduction

An important step in the lengthy process of improving resistance to natural hazards is the development of a Local Mitigation Strategy. The Monroe County LMS was prepared in accordance with the guidelines provided by the Federal Emergency Management Agency and the Florida Department of Community Affairs, and steps outlined in guidance documents for the National Flood Insurance Program's (NFIP) Community Rating System.

The LMS serves several purposes. It sets the stage for long-term resistance to natural hazards through identification of actions that will, over time, reduce the exposure of people and property. Further, the LMS is required to be eligible for certain state and federal mitigation grant funds.

Chapter 5 and Chapter 6 provide overviews of hazards that threaten the County, estimates of the people and property exposed to hazards, the planning process, how hazards are recognized in the local government processes and functions, and priority mitigation action items. The hazard summary and disaster history help to characterize future hazards. When the magnitude of past events, the number of people and properties affected, and the severity of damage, hurricanes and coastal storm flooding hazards clearly are the most significant natural hazard to threaten Monroe County.

The LMS Working Group acknowledges that many buildings were built before the adoption of regulations for development in floodplains in the County and the incorporated municipalities. Current regulations require new development to be designed and built to resist anticipated wind and flood hazards. Older buildings, then, may reasonably be expected to sustain more property damage than new buildings.

3.2 The Mitigation Planning Process

The LMS Working Group followed a well-established planning process to revise the LMS. Four meetings were held during which the LMS revision was discussed; meeting agendas and minutes are on file with the OEM:

- **February 15, 2005**. Overview of the process to revise the LSM, summarize hazard events that have occurred since 1999, review the mitigation goals, and request that Work Group members review and report on mitigation activities initiated or completed since 1999.
- **March 24, 2005**. Discussed rationale for designating facilities as critical, important or standard; data to be gathered for critical facilities; a database of

potential and past mitigation actions to simplify tracking; and options for simplifying the process to put projects on the list and prioritizing them.

- **May 24, 2005**. The LMS met to review the approval and adoption process for the revised LMS and discussed the importance of having adoption scheduled simultaneously in all jurisdictions. The Work Group reviewed the mitigation goals formulated for the 1999 LMS (and made one minor addition) and the process of adoption of a single document by multiple jurisdictions. Importantly, it was decided to revise the process to identify and prioritize initiatives in a two-step process; a tentative schedule was proposed. And finally, the Work Group decided to set as an initiative, completion of the Critical Facilities database.
- **June 20, 2005**. Review public comments; revisit Work Group initiatives; approve LMS Revision and forward it to the State and FEMA for review and subsequently, to governing bodies for formal adoption.

The overall mitigation planning process, summarized below, was facilitated by a mitigation planning consultant:

- **Get Organized.** The Monroe County LMS Working Group was charged with coordinating a committee comprised of County and city representatives to review and revise the LMS.
- **Coordinate.** Prior to the February 15, 2005, meeting, other agencies and other interested organizations were notified of the planning activity and invited to participate.
- **Hold Public Meeting.** The February 15, 2005, meeting of the LMS Working Group was advertised as a public meeting to introduce the process to revise and update the LMS.
- **Identify Hazards.** The LMS Work Group reviewed the hazard identification materials from the 1999 LMS and hazard events that have occurred, and confirmed the priority ranking of natural hazards.
- **Review how Natural Hazards are Addressed.** Work Group members reviewed brief descriptions of their agencies and on-going actions related to hazards and provided updates. The results are summarized in Chapter 6 (Monroe County) and Chapters 8 through 12 for the cities of Key West, Key Colony Beach, Layton, Islamorada and Marathon.
- **Assess Risks.** Summary materials on risks from the 1999 LMS were reviewed and updated by the Work Group members.
- **Confirm the Mitigation Goals.** The mitigation goals were confirmed.
- **Identification of Mitigation Actions.** The list of potential mitigation actions is not static, it changes as new projects are identified, as projects are completed, and as the priorities of proponents change or better information about the feasibility and cost-effectiveness of an activity comes to light. The Work Group

concurred with the importance of improving the method by which the list of actions is maintained and updated periodically.

- **Draft the Revised LMS.** The revised LMS, formulated primarily from the material developed for the 1999 LMS, was prepared in a format designed to fulfill the planning requirements. The draft was circulated to LMS Working Group members and electronic copies were provided to adjacent communities, interested parties, and pertinent state and federal agencies. Comments were collected and incorporated into the "public review" draft.
- **Hold Public Meeting.** Notices of the public meeting and the availability of the Public Review Draft LMS were published in *The Keynoter, Key West Citizen, Upper Keys Reporter,* and *The Free Press Newspaper,* and the Draft LMS was presented at the public meeting held on June 19, 2005. [XX *double check that notice is published in the 4 papers per Nicole*
- **Adopt LMS.** The LMS was presented to the Monroe County Board of County Commissioners and the governing bodies of the Village of Islamorada, the City of Layton, the City of Key Colony Beach, the City of Marathon, and the City of Key West. Copes of the resolutions of adoption are found in Appendix B.

3.3 Public Involvement in Mitigation Planning

Consistent with the standard practices to inform and provide citizens the opportunity to comment, and to fulfill the public involvement requirements of the mitigation planning programs, the input was solicited and residents were notified and invited to review the LMS and attend a public meeting. In January 2004, a letter advising that the County and cities were initiating the planning process, including a public meeting, was sent to selected state and federal government agencies, neighborhood associations and other interested and related organizations.

3.3.1 Public Meetings

The first public meeting on February 15, 2005, was advertised in *The Keynoter* and *The Free Press Newspaper* and a notice was posted on the County's web page. Other than the Work Group members and representatives from a number of non-profit organizations, the meeting was not attended by the general public.

[XX *this text is placeholder to report on the FINAL public meeting* –] The Monroe County LMS (Public Review Draft) was scheduled for presentation to the public at a meeting on June 19, 2005. Notice of the meeting was published in *The Keynoter, Key West Citizen, Upper Keys Reporter,* and *The Free Press Newspaper*. Prior to the meeting, copies of the Public Review Draft were made available to the public in [XX *list County/city offices where hardcopies will be placed*] and posted on the County's web page. A notification letter was

sent to adjacent communities, federal and state agencies, and neighborhood associations. [XX *insert summary of comments received from the public, if any.*

Chapter 4: Mitigation Goals

4.1 Introduction

State and federal guidance and regulations pertaining to mitigation planning require the development of mitigation goals to reduce or avoid long-term vulnerabilities to identified hazards. Mitigation goals have been established by the Federal Emergency Management Agency, the State of Florida, and Monroe County's LMS Working Group.

4.2 LMS Mitigation Goals

State and federal guidance and regulations pertaining to mitigation planning require the identification of mitigation goals that are consistent with other goals, mission statements and vision statements. The Monroe County Comprehensive Plan (Year 2010) includes **Goal 217:** "Monroe County shall develop and implement a program of hazard mitigation and post-disaster redevelopment to increase public safety and reduce damages and public expenditures."

The LMS Working Group first developed a set of goals as part of the 1999 LMS. These goals were reviewed and confirmed for the LMS revision in 2005, with one minor addition.

Monroe County Local Mitigation Strategy Goals

- *Preservation of sustainability of life, health, safety and welfare.*
- *Preservation of infrastructure, including power, water, sewer and communications.*
- *Maintenance and protection of roads and bridges, including traffic signals and street signs.*
- *Protection of critical facilities, including public schools and public buildings.*
- *Preservation of property and assets.*
- *Preservation of economy during and after disaster, including business viability.*
- *Preservation and protection of the environment, including natural and historic resources.*

4.3 Florida's Mitigation Vision & Mission Statement

The Florida *State Hazard Mitigation Plan* was revised in 2004 and approved by FEMA in 2005. The Plan outlines the State's mitigation vision, primary goals and a wide variety of actions.

Florida's Mitigation Vision & Mission Statement

VISION: Florida will be a disaster resistant and resilient state, where hazard vulnerability reduction is standard practice in both the government and private sectors.

MISSION: Ensure that the residents, visitors and businesses in Florida are safe and secure from natural, technological and human induced hazards by reducing the risk and vulnerability before disasters happen, through state agencies and local community communication, citizen education, coordination with partners, aggressive research and data analysis.

4.4 FEMA's Mitigation Goals

FEMA's mitigation strategy is set forth in a document originally prepared in the late 1990s. This strategy is the basis on which FEMA implements mitigation programs authorized and funded by the U.S. Congress.

FEMA's National Mitigation Goals

To engender fundamental changes in perception so that the public demands safer environments in which to live and work; and

To reduce, by at least half, the loss of life, injuries, economic costs, and destruction of natural and cultural resources that result from natural disasters.

Chapter 5: Hurricanes & Coastal Storms

Since 1965, eleven of the thirteen events that prompted Presidential disaster declarations have been associated with tropical cyclones and coastal storms (Table 5-1). One declaration was for fire hazard and one was for a severe cold spell that affected South Florida.

Table 5-1. Presidential Disaster Declarations (1965-2004)

DR#	Date of Declaration	Event	Type of Assistance Provided*
209	09/14/1965	Hurricane Betsy	IA,PA-ABCDEFG
337	06/24/1972	Tropical Storm Agnes	IA,PA-ABCDEFG
955	08/24/1992	Hurricane Andrew	IA,PA-ABCDEFG
982	03/22/1993	Tornadoes, Flooding, High Winds & Tides, Freezing	IA,PA-ABCDEFG
1204	02/20/1998	Severe Storms, High Winds, Tornadoes & Flooding	IA,PA-ABCDEFG
1223	06/19/1998	Extreme Fire Hazard	PA-ABCDEFG
1249	09/28/1998	Hurricane Georges	IA,PA-ABCDEFG
1259	11/06/1998	Tropical Storm Mitch	IA,PA-ABCDEFG
1306	10/22/1999	Hurricane Irene	IA,PA
1345	10/04/2000	Severe Storms & Flooding	IA
1359	02/06/2002	Severe Winter Storm	Disaster unemployment
1539	08/11-30/2004	Tropical Storm Bonnie & Hurricane Charlie	IA
1551	09/13/2004	Hurricane Ivan	PA-B

* IA = Individual Assistance; PA = Public Assistance (and categories)

5.1 Defining the Hazard

The most significant hazards that could affect Monroe County are winds and flooding associated with tropical cyclones (hurricanes, tropical storms, and tropical depressions) and non-tropical coastal storms. Non-tropical coastal storms are less common, although such storms can be produce high winds and flooding rains.

The Monroe County *Comprehensive Emergency Management Plan* states that "the Florida Keys has one of the highest probabilities of being affected by tropical cyclones in the Continental United States," a characterization that is echoed by the National Hurricane Center.

Most of Monroe County has natural elevations of about 4 to 7 feet above mean sea level. This makes the area vulnerable to coastal flooding. The flatness of the topography means that heavy rainfall may accumulate due to slow runoff.

Hurricanes and tropical storms, as well as tropical depressions, are all tropical cyclones defined by the National Weather Service, National Hurricane Center, as warm-core non-frontal synoptic-scale cyclones, originating over tropical or subtropical waters, with organized deep convection and closed surface wind circulation about a well-defined center. Once they have formed, tropical cyclones maintain themselves by extracting heat energy from the ocean at high temperatures and releasing heat at the low temperatures of the upper troposphere. Hurricanes and tropical storms bring heavy rainfalls, storm surge, and high winds, all of which can cause significant damage. These storms can last for several days, and therefore have the potential to cause sustained flooding, high wind, and erosion conditions.

Tropical cyclones are classified using the Saffir-Sampson Hurricane Scale (Table 5-2) which rates the intensity of storms based on wind speed and barometric pressure measurements. The scale is used to predict potential property damage and flooding levels from imminent storms. Actual impacts are influenced by many variables that are not accounted for in this summary, such as the influence of the tidal cycle.

"A hurricane is when the wind blows so hard, the ocean gets up on its hind legs and walks right across the land."

from the movie "Key Largo"

Table 5-2. Saffir-Sampson Scale and Typical Damages

Category	Sustained Wind Speeds (mph)	Surge (ft)	Pressure (mb)	Typical Damage
Tropical Depression	<39	--	--	
Tropical Storm	39-73	3-5	--	Trees/foliage, unanchored mobile homes, signs, flooding on barrier islands/coastal roads, minor pier damage, small craft torn from moorings.
Hurricane 1	74-95	4-5	> 980	*Minimal* – Damage is done primarily to shrubbery and trees, unanchored manufactured homes are damaged, some signs are damaged, no real damage is done to structures on permanent foundations.
Hurricane 2	96-110	6-8	965-980	*Moderate* – Some trees are toppled, some roof coverings are damaged, and major damage is done to manufactured homes.

Table 5-2. Saffir-Sampson Scale and Typical Damages

Category	Sustained Wind Speeds (mph)	Surge (ft)	Pressure (mb)	Typical Damage
Hurricane 3	111-130	9-12	945-965	*Extensive Damage* – Large trees are toppled, some structural damage is done to roofs, manufactured homes are destroyed, and structural damage is done to small homes and utility buildings.
Hurricane 4	131-155	13-18	920-945	*Extreme Damage* – Extensive damage is done to roofs, windows, and doors; roof systems on small buildings completely fail' some curtain walls fail.
Hurricane 5	> 155	> 18	< 920	*Catastrophic Damage* – Roof damage is considerable and widespread, window and door damage is severe, there are extensive glass failures, some buildings fail completely.

Storm surge is a large dome of water which may be 50- to 100-miles wide and rising from less than 4-feet to over 18-feet high. Generally, surges begin to arrive before a storm's landfall, although the timing is influenced by the path, forward speed, and timing of each storm with respect to the tide cycle. Wind-driven waves are a significant component of tropical cyclones. The height of waves is influenced by storm characteristics and whether shorelines are buffered by barrier islands.

Storm surge can be modeled by various techniques; one such technique is the use of the National Weather Services' Sea, Lake and Overland Surges from Hurricanes (SLOSH) model. The model is used to predict storm surge heights based on hurricane category. Surge inundation areas are classified based on the category of hurricane that would cause flooding. As the category of the storm increases, more land area will become inundated. Storm surge is a major component of Nor'easter storms along the East Coast of the U.S. Because winds are moving from a north and/or eastward position, winds move across the ocean towards shore and form large waves.

5.1.1 Flood Insurance Rate Maps

The National Flood Insurance Program (NFIP) prepares maps to depict areas that are predicted to flood during events up to and including the 1-percent annual chance flood (commonly called the 100-year flood). In Monroe County, virtually all areas shown on the

Flood Insurance Rate Maps (FIRMs) are impacted by coastal flooding, whether due to hurricanes or other coastal storms.

In order to make federal flood insurance available to citizens, communities adopt FIRMs and administer floodplain management ordinances. Table 5-3 indicates when the County and cities first joined the NFIP and the date of the current map. Monroe County and the cities were among the first to have maps revised and updated into the Geographic Information System format under FEMA's Map Modernization initiative. FEMA's Multi-Year Flood Hazard Identification Plan (MHIP) indicates that funding for the Monroe County FIRMs was provided prior to Fiscal Year 2004.

Table 5-3. Flood Insurance Rate Maps

	Joined the NFIP	Date of Current Map
Monroe County	June 15, 1973	February 18, 2005
Islamorada	October 1, 1998	February 18, 2005
Key Colony Beach	July 16, 1971	February 18, 2005
Key West	September 3, 1971	February 18, 2005
Layton	July 13, 1971	February 18, 2005
Marathon	October 16, 2000	February 18, 2005

5.2 Hurricane Effects in Monroe County

Hurricane modeling prepared for South Florida predicts surge depths for different categories as a function of track path. Some paths are predicted to producer higher surges than others. Throughout Monroe County, most locations will experience surges of 9-feet or more as a result of category 3, 4 and 5 hurricanes (Table 5-4). Chapters 8 through 12 include tables detailing maximum predicted water depths above mean seal level in Key West, Key Colony Beach, Layton, Marathon, and Islamorada.

Table 5-4. Probably Storm Tide Ranges*

Saffir-Simpson	Elevation (above MSL)	
	Monroe	Dade
Category 1	5	5
Category 2	7	7
Category 3	10	10
Category 4	13	13
Category 5	+15	+15

* Lower Southeast Florida Hurricane Evacuation Study (1983)

Assigning frequencies to hurricanes is difficult, in large part because of the relatively short record. Bases on past storms, it appears that the frequency for a Category 5 storm in Key West is one every 36 years (or about 3-percent change in any given year – by comparison, the "100-year" storm has a 1-percent change of occurring in any given year). A Category 4 storm is likely to occur about once every 22 years (or about 5-percent in any given year). Category 3, 2, and 1 hurricanes and tropical storms have increasing probabilities of occurrence in any given year. Overall, Monroe County has been advised that in any given year, there is a one in four change (25-percent) that the area will be affected by a tropical cyclone of some intensity.

One of the greatest threats posed by hurricanes is their erratic and irregular tracks, making prediction of landfall difficult. Between 1886 and 2004, 47 tropical cyclones of hurricane intensity have passed within 125 miles of Marathon, in the Middle Keys, with an average of one storm every 2.5 years. Hurricanes are most common in September and October, although they have occurred in all months of hurricane season.

5.3 Some Major Hurricanes

The Florida Keys have experienced many hurricanes and tropical storms – too many to list. Brief descriptions of some or the more significant storms (Table 5-5) are sufficient to characterize the hurricane history of the area.

Table 5-5. Some Major Hurricanes that Affected Monroe County

1919 Hurricane (September 2-15). The hurricane passed Key West and the Dry Tortugas on a westward course. Key West recorded winds of 95 mph, with a barometric pressure of 28.81 inches. Water levels were 5-7 feet above Mean Sea Level (MSL)
1929 Hurricane (September 22 to October 4). The hurricane crossed over Key Largo on a northerly course. Key Largo reported winds estimated at over 100 mph, a central barometric pressure of 28 inches, and tide levels of 8-9 feet above MSL. Key West experienced tide levels of 5-6 feet above MSL and winds of 66 mph.
1935 Hurricane (August 29-September 10). The small, extremely violent, Category 5 hurricane crossed the Florida Keys on a northwesterly track. The Tavernier-Islamorada area reported winds estimated at 120 mph with gusts from 190-210 mph. Tide levels ranged from 14 feet above MSL in Key Largo to 18 feet above MSL in Lower Matecumbe Key. The storm was so intense and tightly wrapped that Key West had tide levels of only 2 feet above MSL and average sustained winds of less than 40 mph. Tragically, the storm caused the death of many WWI veterans who were working on construction of Henry Flagler's Overseas Railroad. The 1935 Keys Hurricane remains the strongest storm ever to hit the Continental U.S.
Hurricane Donna, 1960 (August 29-September 19). Hurricane Donna curved northwestward over the Middle Keys near Long Key/Layton and then traveled northward toward the Gulf Coast towns of Naples and Fort Myers. Areas in the vicinity of the storm experienced winds speed of 128 mph and a central pressure of 28.44 inches. The storm affected the Everglades with estimated winds of 150 mph. Tide

Table 5-5. Some Major Hurricanes that Affected Monroe County

levels were reported at Upper Matecumbe Key of 13.5 feet above MSL, at Plantation Key 10+ feet above MSL, and 8.9 feet above MSL in Key Largo. As of 1992 Hurricane Donna, a Category 4 storm, was listed as the 6th most intense hurricane in the U.S.
Hurricane Betsy, 1965 (August 26-Septmber 12). Hurricane Betsy passed over Marathon while moving westward into the Gulf of Mexico. The lowest central pressure was measured in Tavernier at 28.12 inches and wind speeds were estimated to be 120 mph. Tide levels in Tavernier were 7.7 feet above MSL and Key Largo had tide levels of around 9 feet above MSL.
Hurricane Andrew, 1992. This storm made landfall in southern Dade and northern Monroe Counties in the early morning hours of Monday, August 24, 1992. A strong Category 4, the storm severely affected Monroe County in the Key Largo area, particularly North Key Largo and the community of Ocean Reef. According to National Hurricane Center, maximum sustained winds for this storm were 145 miles per hour, with gusts to 175 miles per hour. At landfall, its central barometric pressure was, 926 Mb, is the third lowest in the 20th Century. At the time, Hurricane Andrew was the third strongest storm this Century. Storm tides at Ocean Reef have been estimated at about 4.5 feet on the bay side and 3.9 to 5.0 feet on the ocean side. Because of the storm's intensity and tight configuration, it quickly moved inland. Hurricane Andrew was costly for Monroe County, including extensive roof and other structural damage to residences; public safety and administrative buildings; the Card Sound Road toll facility; and resort buildings; loss of emergency equipment; severe damage to roadways and signs; loss or emergency and security vehicles; and damage to marinas and craft. Other expenses accrued from large-scale landscape loss and damage; loss of and damage to private vehicles; damage to recreational facilities; and great loss of personal property. Many businesses in Upper Key Largo experienced some damage (especially roofs) and loss of signs and landscaping. County roadways were blocked by debris and street and road signs were lost. The Florida Keys Electric Coop reported $130,000 in losses of utility poles and related infrastructure. Total damage in Monroe County exceeded $131,000,000.
Hurricane Georges, 1998. On September 25, 1998, this hurricane made landfall in the Lower Keys and affected the entire county to some extent. Hurricane Georges devastated the Caribbean, including Haiti and the Dominican Republic, Puerto Rico, and Cuba before taking aim at Monroe County. When it hit Santo Domingo in the Dominican Republic on September 22nd, it was a strong Category 3 with sustained winds of120 mph. It weakened to a Category 2 by the time it arrived in the Florida Keys, with maximum sustained winds of 92 mph measured at the Naval Air Station (Boca Chica) near Key West. Gusts of 110 mph were reported in Marathon. According to the Key West Weather Service, precipitation levels in the Lower Keys were identified as 8.65 inches on the south side of Sugarloaf Key, 8.38 inches at Key West International Airport, 8.20 inches on Cudjoe Key, and 8.4 inches at Tavernier in the Upper Keys. The most severe damage was sustained between Sugarloaf Key and Big Pine Key in the Lower Keys. Damage estimates, including insurable, uninsurable, and infrastructure loss, was nearly $300 million. Substantial damage occurred to mobile homes and landscaping throughout the keys. Roof and flood damage occurred in several areas including Big Coppitt, Sugarloaf, Summerland, Ramrod, and Big Pine in the Lower Keys. Similar damage affected the Middle Keys including Marathon, Key Colony Beach, Grassy Key, Long Key/Layton, and Duck Key. In the Upper Keys, several hotels and motels, such as the Cheeca Lodge received damage as did portions of roadway, e.g. Lower Matecumbe where overwash occurred. A school under construction in Sugarloaf Key sustained damage to the unfinished roof, heavy damage to the Big Pine Community Center, and damage to the air conditioning unit on the roof of Marathon High School, which resulted in interior water damage. The City of Key West sustained damage to private buildings and public property, especially along low-lying areas along South Roosevelt Boulevard.
Tropical Storm Mitch, 1998. Arriving on November 4 and 5, Mitch initially was forecast to bring minimal tropical storm conditions to the Keys. Unfortunately, feeder bands from Mitch containing super cells spawned several damaging tornadoes in the Upper Keys. Sections with mobile homes were especially hard hit. Islamorada experienced an F-1 tornado. Rock Harbor and Key Largo were hit by F-2 tornadoes. The State reported Monroe County's damages were estimated at nearly $11 million.

5.4 Losses Due to Major Disasters

No definitive record exists of all losses – public and private – due to disasters for Monroe County. For the United States as a whole, estimates of the total public and private costs of natural hazards range from $2 billion to over $6 billion per year. Most of those costs can only be estimated. In most declared major disasters, the Federal government reimburses 75% of the costs of cleanup and recovery, with the remaining 25% covered by states and affected local jurisdictions. FEMA reimburses expenditures those associated with:

- Public assistance for certain categories of damage/expenditures: debris removal, emergency services, roads and bridges, flood control facilities, public buildings and equipment, public utilities, and parks and recreational facilities; and
- Assistance paid out for individual assistance grants, emergency food and shelter, and other assistance to individuals.

Table 5-6 summarizes some costs associated with disaster recovery from just two significant storms in the past decade, including estimates of some costs that were covered by insurance (private wind coverage and federal flood insurance).

Table 5-6. Some Disaster Recovery Costs*

Hurricane Georges Damage As Of September 1, 1999	
Public Assistance (Infrastructure & Emergency Activities)	$ 54,257,290
Temporary Housing	$ 6,584,782
Individual Assistance	$ 3,966,572
Small Business Administration	$ 61,366,100
National Flood Insurance Program	$ 38,044,669
Wind Insurance (est.)	$131,000,000
TOTAL	$ 295,219,413
Tropical Storm Mitch Damage As Of September 1, 1999	
Public Assistance (Infrastructure & Emergency Activities)	$ 4,021,718
Temporary Housing	$ 754,845
Individual Assistance	$ 395,663
Small Business Administration	$ 5,678,700
National Flood Insurance Program	$ 51,527
TOTAL	$ 10,902,183

* Florida DCA, Recovery & Mitigation Section (pre-1999)

The Emergency Management Division of the Florida Department of Community Affairs coordinates and administers aspects of FEMA's Public Assistance Program. For three major disaster declarations that included Monroe County, Table 5-7 summarizes the amounts of public assistance received by eligible recipients, including Monroe County, the cities, and eligible non-profit organizations. The data were not available by category; thus, it is not feasible to examine the types of damage and expenditures that resulted in the expenditures which might reveal mitigation opportunities.

Table 5-7. FEMA Public Assistance Reimbursements for Recent Disasters (as of June 2005).*

	Amount of Reimbursements		
Recipient	Hurricane Georges DR#1249	Hurricane Mitch DR#1259	Hurricane Irene DR#1306
Monroe County	$26,618,853	$2,337,920	$602,420
City of Key West	11,586,282	0	$8,020,253
City of Marathon	0	0	0
City of Key Colony Beach	0	0	0
City of Layton	0	0	0
Islamorada Village of Islands	$1,201,225	$291,483	0
Monroe County Housing Authority	$162,065	0	$3,381
Monroe County Mosquito Control	$18,247	0	0
Monroe County School District	$5,718,562	$131,733	$55,322
Key West Housing Authority	$117,094	0	0
Utility Board of Key West	$6,055,656	0	$219,031
Marathon Volunteer Fire & Rescue	$2,678		
Florida Keys Electric Cooperative	$628,396	$260,512	$175,307
Florida Keys Aqueduct Authority	$601,763	0	0
Historic Florida Keys Foundation	$12,654	0	0
Key West Art & Historical Society	$16,562	0	0
Monroe Association for Retarded Citizens	$11,054	0	0
Florida Keys Children's Shelter	$1,286	0	0
Florida Keys Outreach	$2,500	0	0
Pigeon Key Foundation, Inc	$71,760	0	0
Venture Out at Cudjoe Cay	$256,603	0	0
	$53,083,227	$3,021,647	$9,075,714

* Source: Florida Department of Community Affairs, Emergency Management, Public Assistance

5.5 Impacts of Hurricanes

To improve understanding of hurricanes and their impacts, the Florida Department of Community Affairs developed "The Arbiter of Storms" (TAOS). TAOS is an integrated hazards model that provides higher resolution data than are produced by the National Hurricane Center's SLOSH model. The SLOSH model calculates storm surge for an area of coastline called a basin. TAOS, which makes more extensive use of satellite and digital terrain data, has a higher resolution. In addition to storm surge estimates, TAOS calculates estimates of wave height, maximum winds, inland flooding, debris and structural damage. Computer models are approximations and all predications of storm impacts and damage that are based on models include some degree of uncertainty.

In 1998, estimates of projected damage for various land use types in different storm scenarios developed through the TAOS model were provided by the Department of Community Affairs. The projections include the number of parcels by type, total improved value, and six storm scenarios (tropical storm and all categories of hurricane). Anticipated damage is included for floods, winds, and wave action.

5.5.1 Buildings

Property values throughout Monroe County have increased significantly in recent years. Figure 5-1 shows how the average and median sale prices of single family homes have changed since 1965. When the 1999 LMS was prepared, the average property value was $120,000; as of mid-2005, the average value had climbed to $281,000. Similar increases have been experienced in the values of other types of properties. The average sale prices of mobile homes on single lots have risen from about $100,000 to nearly $250,000; condominiums have gone from about $200,000 to about $450,000.

Exposure to Hurricane Wind*
Residential Property: $9.3 million
Commercial Property: $2.1 million

Annualized Losses from Hurricane Wind**
Residential Losses: $137 million
Commercial Losses: $31 million

Tables 3.3.6* & 3.5.2**
Florida State Hazard Mitigation Plan (2004)

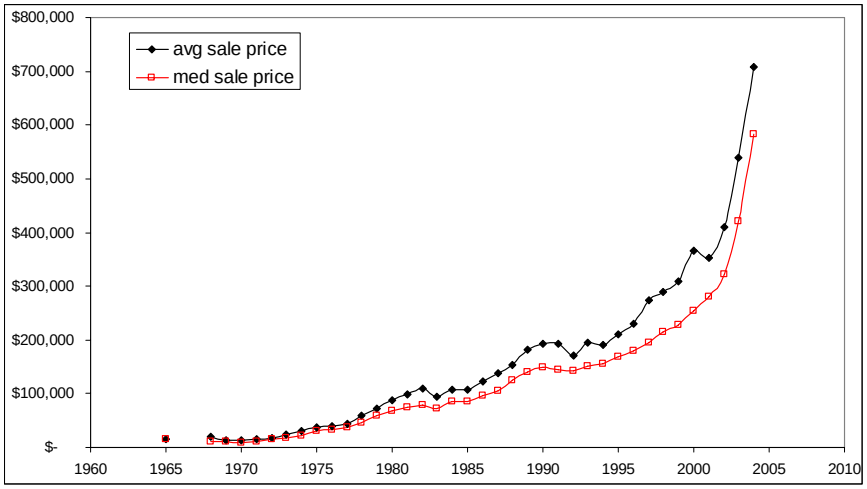


Figure 5-1. Single Family Home Values in Monroe County (Monroe County Property Assessment Office)

The Monroe County Property Appraisal Office reports that there are 109 mobile home/recreational vehicle parks (land owned by park operator) and over 6,000 parcels of land are identified as "individual manufactured housing" lots. New mobile home parks have not been approved since 1987. Installation of new or replacement units must comply with current codes.

Three hundred sixty-six parcels of land are recorded as "hotel/motel" and it is estimated that there are over 8,900 available rooms (including guest houses). Most were built before current strict standards related to wind and flood hazards. Additions or substantial renovation will trigger the need to comply with current codes.

A need for affordable housing has been identified in the County and Municipal Comprehensive Plans and was underscored by the experiences in Hurricane Georges and Tropical Storm Mitch. Table 5-9 indicates the number of housing units that were determined to have been destroyed or to have sustained major or minimal damage.

Table 5-9. Monroe Housing Units Affected by Hurricane Georges & Tropical Storm Mitch

	Total Affected	Degree of Damage		
		Minimal	Major	Destroyed
Hurricane Georges	1,854	893	470	173
Tropical Storm Mitch	664	165	40	43

The TAOS information covers the entire county and does not provide separate data on the incorporated municipalities. Tables 5-10 through 5-16 summarize the damage projections for single-family homes, manufactured homes, multi-family homes, other residential buildings, commercial property, institutional property and hotels.

Although the TAOS projections were prepared for the 1999 LMS, the value of the results is not in the precision of the numbers, but in the order of magnitude or projected damage. For example:

- A category 3 hurricane is projected to result in some degree of damage to all occupancies, totally on the order of 50% of improved value.
- All single family homes will experience some degree of damage in all storms, with total structural damage approaching 100% in a Category 5 hurricane.
- All manufactured homes will be damaged to some degree in all storms, with total damage approaching 100% in a Category 3 hurricane.
- All multi-family residential buildings, other residential buildings, hotels, commercial buildings, and institutional buildings will be damaged to some degree in all storms, with total structural damage approaching 100% in a Category 5 hurricane.

Table 5-10. TAOS Damage Projections: Single-Family Homes (Total Parcels = 16,618; Improved Value = $3.01 billion, 1998 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	8,565	16,618	16,618	16,618	16,618	16,618
Damage ($000s)	Total Structure	243	686	1,066	1,571	2,248	2,946
	Structure Flood	100	245	413	620	848	1,128

Table 5-10. TAOS Damage Projections: Single-Family Homes
(Total Parcels = 16,618; Improved Value = $3.01 billion, 1998 dollars)

	Structure Wind	0	50	188	492	1,102	2,380
	Structure Wave	139	40	518	657	830	10,819
	Total Content	63	169	3,295	696	1,217	1,487

Table 5-11. TAOS Damage Projections: Manufactured Homes
(Total Parcels = 5,881; Improved Value = $308 million, 1998 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	5,881	5,881	5,881	5,881	5,881	5,881
Damage ($000s)	Total Structure	116	169	235	304	308	308
	Structure Flood	26	52	80	110	155	221
	Structure Wind	9	51	135	297	308	308
	Structure Wave	92	111	123	137	155	183
	Total Content	11	46	99	152	153	154

Table 5-12. TAOS Damage Projections: Multi-Family (<10)
(Total Parcels = 1,312; Improved Value = $250 million, 1998 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	522	1,312	1,312	1,312	1,312	1,312
Damage ($000s)	Total Structure	14	41	68	112	173	243
	Structure Flood	6	14	17	43	61	84
	Structure Wind	0	4	15	40	90	196
	Structure Wave	8	22	28	36	47	66
	Total Content	3	10	19	49	94	123

Table 5-13. TAOS Damage Projections: Other Residential
(Total Parcels = 7,652; Improved Value = $2.3 billion, 1998 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	5,629	7,652	7,652	7,652	7,652	7,652
Damage ($000s)	Total Structure	186	496	809	1,292	2,018	2,262
	Structure Flood	68	136	262	411	617	826
	Structure Wind	13	101	284	654	1,335	2,250
	Structure Wave	106	281	350	419	518	691
	Total Content	37	102	288	633	1,057	1,126

Table 5-14. TAOS Damage Projections: Commercial
(Total Parcels = 1,431; Improved Value = $409 million, 1998 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	1,287	1,431	1,431	1,431	1,431	1,431
Damage ($000s)	Total Structure	43	107	163	250	366	409
	Structure Flood	15	30	49	74	106	142
	Structure Wind	4	20	56	128	259	409
	Structure Wave	25	64	77	93	115	149
	Total Content	10	24	59	121	189	203

Table 5-15. TAOS Damage Projections: Institutional
(Total Parcels = 155; Improved Value = $80 million, 1998 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	142	155	155	155	155	155
Dam age ($000	Total Structure	5	17	28	45	70	80

	Structure Flood	1	4	74	12	18	26
	Structure Wind	1	4	11	25	51	80
	Structure Wave	4	9	11	15	18	24
	Total Content	0.5	2	9	22	36	40

Table 5-16. TAOS Damage Projections: Hotels
(Total Parcels = 215; Improved Value = $614 million, 1988 dollars)

		Tropical Storm	Hurricane Category				
			1	2	3	4	5
	Parcels Damaged	155	215	215	215	215	215
Damage ($000s)	Total Structure	22	72	170	320	563	614
	Structure Flood	5	9	54	97	147	201
	Structure Wind	6	30	85	195	396	614
	Structure Wave	11	35	40	49	63	90
	Total Content	3	7	57	158	294	306

5.5.2 Transportation Infrastructure

Historically, some areas and streets are more vulnerable than others to coastal flooding and/or pooling of rainfall runoff flooding from heavy rains. In the past decade, the following areas have been identified as likely to flood repetitively:

- MM 109 in the Upper Keys, which can hamper evacuation.
- MM 106, Lake Surprise area, vulnerable to the effects of wind driven wave run-up from E/NE and W/SW directions; heavy rainfall results in ponding.
- MM 111, the exposed beach area along the 18-mile stretch bordering Barnes Sound, experiences wave runup or "piling" with strong E and NE winds.
- MM 113, the Point Laura Marina Area, borders Barnes Sound is similarly susceptible to strong E and NE winds.
- MM 73.5 to approximately MM 74.5, the Lower Matecumbe area known as "White Marlin Beach", vulnerable to NE / E / SE wind driven wave run-up.

- MM 30 -31, Big Pine Key. The area north of the Big Pine Plaza Shopping Center encompassing Wilder Road and Key Deer Boulevard, while not normally vulnerable to storm surge effects, experience rainfall ponding.
- MM 9-10, Big Coppitt Key, Bayside, experiences wind-generated wave run-up.

Transportation disruptions in the Keys occurred during evacuations for Hurricane Andrew and Hurricane Georges. Following Tropical Storm Mitch and Hurricane Georges, debris on U.S. 1 somewhat impeded traffic flow.

Both of the areas airports, Key West Airport and Marathon Airport, were closed before Hurricane Georges moved through the area. Damage to the airfield lighting at the Key West Airport closed the facility for five days. The Marathon Airport did not suffer any notable physical damage, but was closed for four days for debris removal and assessment and repair.

5.5.3 Communications

Most telephone service in the Keys is directed through facilities in Miami, although some local capability provides services within single exchanges. To ensure redundancy, two major trunk fibers are furnished from Homestead on the mainland to Key West (one buried and one aerial). However, most cable lines are located along the underside of fixed bridges, making them vulnerable if bridges fail. Installing sub-surface cable is not feasible because of rock substructure; environmental considerations inhibit underwater installations.

Communications infrastructure suffered in Hurricanes Andrew and Georges, downing towers and antennas in Dade County (cell towers, radio and TV towers, and repeaters) and damaging poles and switching equipment. The NOAA weather radio transmitter in Key Largo was damaged in Hurricane Andrew. Winds associated with Hurricane Georges destroyed the Key West Police Department's communication's tower. Major communication problems result from loss of electrical power.

5.5.4 Water Supply

Although Monroe County receives approximately 42 inches of rainfall per year, there are virtually no fresh water sources in the Upper Keys due to characteristics of the underlying limestone base rock. Some small fresh water lenses exist in the Lower Keys, primarily in Big Pine Key and Key West. Consequently, virtually all-potable water comes from the Biscayne Aquifer in Florida City via pipeline owned and operated by the Florida Keys Aqueduct Authority. The main pipeline that connects to the Upper Keys is laid underwater;

some distribution pipelines are connected to roads and bridges and thus vulnerable to washout.

The Florida Keys Aqueduct Authority is an independent Special District created by the State of Florida Legislature, with the primary purpose and function to obtain, treat and distribute an adequate water supply to the residents and businesses of the Florida Keys. In 1998, the Florida Legislature modified the Authority's enabling Act to include providing wastewater collection, treatment and disposal throughout the unincorporated areas of Monroe County, with the exception of Key Largo. The Authority manages the infrastructure used to supply water and wastewater services to its customers in the Florida Keys, sets rates and provides customer service.

The Florida Key's Aqueduct Authority's mitigation and response activities include:

- The Authority's pipeline originates in Florida City in south Miami-Dade County. It ensures that the supply is protected from hazards and complies with South Florida Water Management Districts permit requirements, including identification and use of alternative sources. The Authority also operates and maintains two Reverse Osmosis emergency water treatment plants in the Florida Keys, to provide an alternate source when water cannot be supplied through the pipeline.
- The Authority participates in developing policies and procedures for responding to and recovering from shortages or disruptions in the supply and delivery of electricity, potable water, waste water collection and treatment and other fuels which affect or threaten to affect significant numbers of citizens and visitors.

The Authority, an agency of the State, has contingency plans and works diligently to provide water in the event of a hurricane in the Keys. Although not required to obtain local building permits, FKAA is required to meet or exceed the latest edition of the Florida Building Code when building or renovating its facilities. In addition, FKAA complies with the minimum design standards for flood protection of water and wastewater infrastructure and the standards set by the Florida Department of Environmental Protection. Some redundancy for the regular supply line was provided by restoring two reverse osmosis plants: the Marathon facility would serve the Middle Keys and the Stock Island (Key West) facility would serve the Lower Keys. All primary pumping and water treatment facilities have backup power generation capability.

Hurricane Andrew: The water treatment plant in Florida City was damaged (lost roof on control room; roof on high service pump building; loss of Quonset hut; other minor building

damage; partial loss of communication system). The only impact to customers was discontinuation of lime softening at the plant.

Hurricane Georges: The Florida Keys Aqueduct Authority reported that little, if any, disruption occurred in the transmission system during Hurricane Georges. Distribution system disruptions occurred in isolated areas due to broken water mains caused by uprooted trees. Wave action on the ocean side of the Spanish Harbor Bridge washed out a portion of the approach road and exposed about 250 feet of 24-inch transmission main (subsequently relocated to the roadway). As a private non-profit entity, FKAA was eligible to receive $1.69 million in federal disaster assistance. The assistance was used to rehabilitate damaged facilities.

All new or replaced pump stations are built above the estimate storm surge level of 14 feet above mean seal level. Other new structures are hardened to help withstand storm damage and protection operational capacity. An existing transmission station was retrofit with floodproofed doors.

Private water wells that draw from shallow freshwater sources can be contaminated by flooding, whether from storm surge or ponded runoff. A number were contaminated by floodwaters in Hurricane Georges, especially on Big Pine Key, where it appears that flooded septic tanks, cesspools and drain fields overflowed. After that event the South Florida Water Management District provided funding to the FKAA to install distribution mains to homes on Big Pine Key that had wells contaminated by the tidal surge. The project also supported environmental objectives related to the Key Deer, and endangered species, by reducing withdrawals from the fresh water lens.

5.5.5 Electric Power

Electric power is supplied by Florida Keys Electric Cooperative from the Upper Keys to Marathon, and by Key West City Electric System from Marathon to Key West. The two agencies cooperate to provide the best service for the area. Both utilities purchase power from larger suppliers.

City Electric has the capability to generate electricity at its plant in Key West. The Electric Cooperative has limited generating capability at its Marathon Plant. With the exception of the private community of Ocean Reef in North Key Largo, the majority of electric lines in the county are above-ground. Due to vulnerability, power poles are not located on bridges but are submerged. Subsequent to Hurricane Andrew, some poles were re-designed to

withstand higher wind forces. Both electric utilities have replaced older equipment with newer, more resilient designs and materials.

Hurricane Andrew: Due to the loss of the Florida Power and Light Company's electrical tie line in Dade County, Monroe County's approximately 78,000 residents were without power or on limited power for approximately two weeks. The Florida Keys Electric Cooperative reported a $130,000 loss of utility poles and related infrastructure. A report by the Florida Sea Grant Program identified lack of power as one the most significant factors affecting businesses and, while such damages were difficult to quantify in a monetary sense, they "left an indelible economic footprint on many businesses in the Keys."

Hurricane Georges: The Lower Keys experienced significant disruption of electric power. Damage to transformers, power poles, and transmission lines was responsible for widespread power outages, especially in areas serviced by Key West City Electric System. Power was restored on a priority basis with efforts directed at hospitals and critical services. Most electricity was reestablished within two weeks; however, as with most disasters, restoration in the hardest hit areas progressed more slowly. Power outages created major economic loss to Key businesses that are heavily dependent on the tourist trade. Disaster related unemployment, primarily due to the lack of electricity was significant because of loss of jobs in the service industry.

[XX *emailed inquiries to Skip Jansen (305/295-1000) and Tim Planer (305/852-2431) on 5/18; resent inquiry June 2*

5.5.6 Wastewater Facilities

The State's Hurricane Georges assessment report noted that domestic wastewater facilities were surveyed in the two weeks following the storm. All regional facilities remained functional throughout the event, including facilities in Key West and Key Colony Beach. Approximately 250 package treatment plants are located throughout the County to serve such uses as motel, mobile home and RV parks, restaurants, and others. The loss of power to these small package plants did not result in overflows. While power was being restored, to prevent health and safety problems sewage was hauled away from these small collection systems.

5.5.7 The Economy

Disruption of the local economy is an anticipated consequence of hurricanes that directly affect the Florida Keys. Although major storms may generate debris and cause building and

infrastructure damage, the most detrimental short-term impact of large and small storms is caused by the loss of electric power. The most significant long-term impact would be caused by major damage to U.S. 1. Lengthy repairs and limited easy access to the Florida Keys would directly affect tourism and the flow of goods.

The Florida Keys are susceptible to economic disruption because the primary industries are related to retail sales, service, tourism, and fishing. Events that cause visitors to stay away would result in economic loss to local businesses and loss of tax income to local governments. The fishing industry would suffer economically with loss of power (affects ice production) and transportation disruption (affects transport to the mainland).

With a relatively high percentage of retirees in the area, interruption in government services that provide social security, disability, unemployment, and welfare payments would result in some economic impacts.

Major disasters can create a "domino effect" that can hurt the economy. For example, major damage and loss to residential properties can lead to displacement of people. Decrease in population means loss of clientele for local businesses. Businesses themselves may be destroyed or damaged to the degree that they cannot operate (whether short- or long-term). Even without initial major population relocation, business closings can contribute to reduced services, leading some to relocate in the short-term. Business closings and destruction or severe damage of facilities like schools, libraries, and other public buildings may eliminate jobs (even in the short-term) may lead some people to leave the area.

The Florida Keys Employment and Training Council has noted the significance of disasters on employee dislocation, unemployment, and underemployment. Because of the nature of the economy and the severe shortage of affordable housing, many employees do not have a stable economic base. Even a minor interruption in business may have serious effects on the work force. Given the already short supply of housing, another complicating factor is the likely reduction in the housing supply due to damage.

Both Hurricane Andrew and Hurricane Georges caused economic disruption in Monroe County, primarily due to the interruption of tourism. In addition, the fishing industry was hard hit due to the loss of many seafood traps, lack of ice for storage, and transportation disruption. Loss of power disrupted not only hospitality and retail businesses, but affected gas stations that could not pump and were slow to receive fuel because of transportation disruptions. The loss of more than 80 channel markers throughout the Keys curtailed

boating and caused the suspension of cruise ship visits. In addition, the County and municipal governments were affected by a reduction in sales, infrastructure, and bed tax revenues immediately after the storm, resulting from business slow-downs

5.4.8 Environmental Resources

After Hurricane Andrew in 1992, the Monroe County Cooperative Extension Service received a grant to study environmental consequences. The study, "The Effect of Hurricane Andrew on Monroe County's Natural Resources and Its Dependent Industries," identified natural resources affected by the hurricane. It states that impacted resources include "pine rocklands, hard wood hammocks, mangrove forests, cypress domes, the freshwater regimes of the sawgrass community, and the coral reefs offshore of Key Largo."

The study notes that although South Florida ecosystems have evolved to adapt to natural episodic massive disturbances, including hurricanes, droughts, wildfires, and freezes, the growth of urban environments has significantly altered the ecology and ability of the ecosystems to respond and recover from catastrophic events.

Mangroves are very important to the environment of the Keys and serve as protective buffers in storms. Hurricane Andrew damaged the mangroves in Everglades National Park as severely as 80-95% in places, although areas south of the hurricanes' eye experienced more limited defoliation and branch damage. The study demonstrated that trees continue to suffer after the passage of a storm; initial estimates of mortality eventually were increased by up to 50%. Delayed mortality has been observed following past hurricanes, sometimes up to 2 years after the initial event.

Marsh Communities appeared to have survived Hurricane Andrew with little apparent damage, although the loss of periphyton, (which fish feed on) could affect "fish abundances." Pineland damage had a positive influence because of increased sapling growth. Hardwood hammocks are more susceptible to wind damage than pines. In North Key Largo, Hurricane Andrew damaged about two-thirds of the upland hardwood hammock trees.

Because Hurricane Andrew came ashore north of Monroe County, the Florida Keys reefs, including those in the Key Largo National Marine Sanctuary, were spared the affects of hurricane force conditions. Hurricanes can cause major damage to coral reefs; in past surveys in Puerto Rico, it was found that major hurricanes leave behind considerable breaks in coral formations.

Hurricanes can have a variety of impacts on fishery resources, including short-term and long-term impacts that are detected only after extended monitoring. After Hurricane Andrew, three species appeared to experience harvest declines in 1992 and 1993: Spanish Mackerel, Dolphin, and Spiny Lobster. In addition, there was a consistent decline in shrimp following the storm, but catches increased in the following year.

A survey of the commercial fishing industry after Hurricane Andrew, found that 53% of 43 survey respondents reported adverse impacts, primarily in the lobster industry because the storm occurred during the lobster season. The industry experienced inventory loss (virtually all 1 million traps were in the water), disruption of utilities (electric power to make ice), communications (for sales transactions), and transportation.

Overall, hurricanes are necessary and natural occurrences for the historical maintenance of the natural environment of the Florida Keys. Although Hurricane Andrew caused a relatively minor disruption of the portion of Monroe County's economy that is based on natural resources, the event pointed out opportunities to mitigate the impacts on the industry. In particular, restoration of power is a high priority.

5.5.8 Historic Resources

In recent years, properties and sites that are listed on the National Register of Historic Places have not sustained major damage due to hurricanes. The Old Monroe County Courthouse, a state-owned building, has suffered wind damage in the past. It was retrofit with window protection using FEMA's Hazard Mitigation Grant Program funds. FEMA's funds also were used to retrofit the steeple of the Old Key West City Hall with motorized hurricane shutters.

Chapter 6: Other Hazards & Risks

6.1 Introduction

Hurricanes and tropical storms pose major risks to Monroe County due to high winds and flooding (the effects of those storms are addressed in Chapter 5). Other natural hazards addressed in this chapter that affect the area to a lesser degree are high winds other than hurricane (severe storms/tornadoes), rainfall flooding, drought, and wildland fires.

Recent advice from NOAA/NWS is that, although extremely rare, some tsunami hazard exists for the Atlantic and Gulf coasts for elevations less than 15 feet above mean high tide and within 300 feet horizontal distance from mean high tide line. There is anecdotal evidence from a 1755 account of conditions in Havana that were thought to be associated with a hurricane that may possibly have been due to a tsunami wave generated by an earthquake in Lisbon, Portugal. In addition, the U.S. Geology Survey's report on earthquake history of Florida states "In January 1880, Cuba was the center of two strong earthquakes that sent severe shock waves through the town of Key West, Florida." (http://neic.usgs.gov/neis/states/florida/florida_history.html) Because seismic and/or tsunami events have been so rare, they are not further considered in this plan.

Hazards that do not affect the area include landslides/sinkholes, dam/levee failure flooding, and winter storms; thus, these hazards are not addressed by this Plan. Winter storms and freezes do not pose risks to agricultural interests and property because of the climatological and meteorological characteristics of the Keys. The winter of 1981 was especially cold, with temperatures in the low 40°s (record low was 35°F at Coral Key Village). The greatest effect of an unusually low temperature would be a resulting low wind chill factor and the National Weather Service issues wind chill advisories from time to time.

Numerous federal agencies maintain a variety of records regarding losses associated with natural hazards. Unfortunately, no single source is considered to offer a definitive accounting of all losses. The Federal Emergency Management Agency maintains records on federal expenditures associated with declared major disasters. The National Climatic Data Center (NCDC) of the National Oceanographic & Atmospheric Administration collects and maintains certain data in summary format, indicating injuries, deaths, and costs, although the basis of the cost estimates is not identified and the reports are not independently verified (http://www.ncdc.noaa.gov/oa/climate/severeweather/extremes.html).

6.2 Severe Storms, Tornadoes & Water Spouts

The term "severe storms" is used to cover weather events that exhibit all or some of these characteristics: high winds (including tornadoes), heavy rainfall, lightning, and hail. Thunderstorms are convective storms produced when warm moist air is overrun by dry cool air. As the warm air rises, thunderhead clouds form and generate strong winds, lightning, thunder, hail and rain. Generally, thunderstorms form on warm-season afternoons and are local in effect. Storms that form in association with a cold front or other regional-scaled atmospheric disturbance can become severe, thereby producing strong winds, frequent lightning, hail, downbursts and even tornadoes.

Of the estimated 100,000 thunderstorms that occur each year in the U.S., only about 10% are classified as severe (produces hail at least ¾ inch in diameter, winds of at least 58 miles per hour, or tornadoes).

Thunderstorms produce lightning – a greater threat to people than tornadoes. Lightning is defined as a sudden and violent discharge of electricity from within a thunderstorm due to a difference in electrical charges and represents a flow of electrical current from cloud-to-cloud or cloud-to-ground. Nationally, lightning causes extensive damage to buildings and structures, kills or injures people and livestock, starts many forest fires and wildfires, and disrupts electromagnetic transmissions.

Figure 6-1 shows Figure 1609 from the Florida Building Code (2004 draft) which

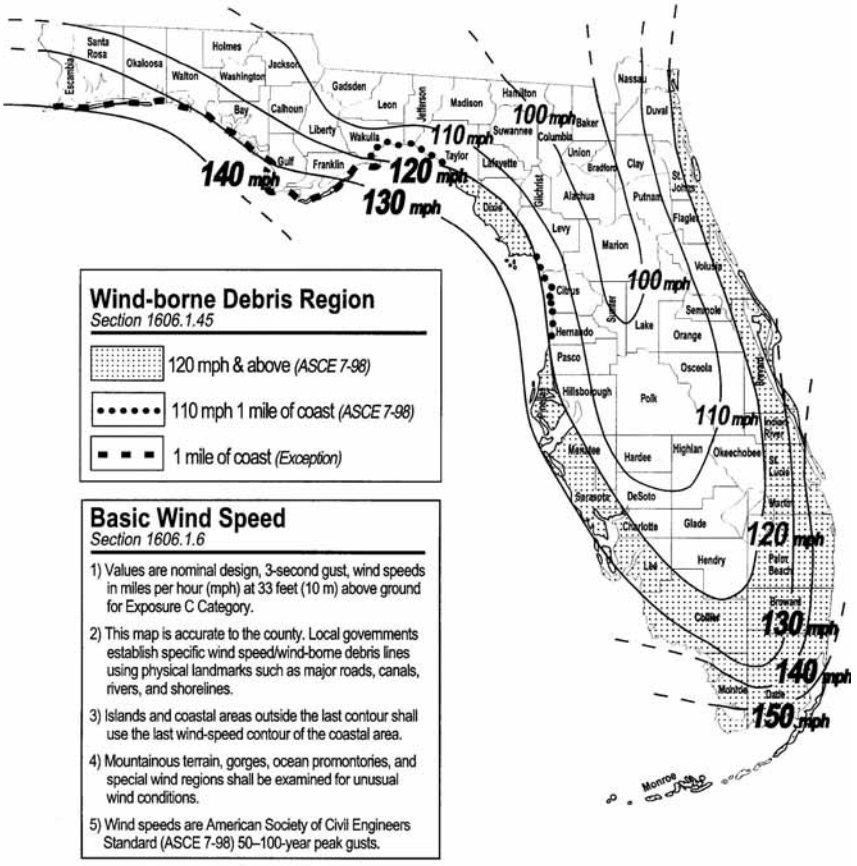


Figure 6-1. Wind-Borne Debris & Basic Wind Speed

delineates windborne debris regions and the "basic wind speed" used to design buildings to withstand reasonably anticipated winds in order to minimize property damage. In Monroe County, the "design wind" speed is 159 miles per hour (3-second gust measured at 33 feet above the ground). A probability or recurrence interval is not assigned to the design wind speed.

A tornado is a relatively short-lived storm composed of an intense rotating column of air, extending from a thunderstorm cloud system. Tornadoes may be spawned from storm systems associated with hurricanes and tropical storms. Average winds in a tornado, although never accurately measured, are thought to range between 100 and 200 miles per hour; extreme tornadoes may have winds exceeding 300 miles per hour. The Fujita Scale classifies tornadoes by wind speed and degree of damage (Table 6-1)

A water spout is a violent rotating column of air that touches the water, often resulting from thunderstorms. Waterspouts that come ashore are classified as tornadoes. Fortunately, most waterspouts dissipate over water and do not result in many deaths or serious injuries. However, over water they are a threat to marine interests.

Table 6-1. The Fujita Scale

Scale	Wind Speeds (miles per hour)	Damage	Frequency*
F-0	40 to 72	Some damage to chimneys, TV antennas, roof shingles, trees and windows	29%
F-1	73 to 112	Automobiles overturned, carports destroyed, trees uprooted	40%
F-2	113 to 157	Roofs blown off homes, sheds and outbuildings demolished, mobile homes overturned	24%
F-3	158 to 206	Exterior walls and roofs blown off homes. Metal buildings collapsed or are severely damaged. Forests and farmland flattened.	6%
F-4	207 to 260	Few walls, if any, standing in well-built homes. Large steel and concrete missiles thrown far distances.	2%
F-5	261 to 318	Homes leveled with all debris removed. Schools, motels and other larger structures have considerable damage with exterior walls and roofs gone. Top stories demolished.	Less than 1%

The typical tornado path is relatively short – on the U.S. mainland, paths range from four miles to as long as 300 miles. Path widths average 300-400 yards, but severe tornadoes

have cut swaths a mile or more in width, or have formed groups of two or three funnels traveling together. On the average, tornadoes move over land at speeds between 25 and 45 miles per hour, but speeds of up to 70 miles per hour have been reported. Tornadoes rarely linger more than a few minutes over a single spot or more than 15-20 minutes in a 10-mile area, but their short periods of existence do not limit the devastation. The destructive power of the tornado results primarily from its high wind velocities, sudden changes in pressure, and windborne debris. Since tornadoes are generally associated with severe storm systems, they are often accompanied by hail, torrential rain and intense lightning. Depending on intensity, tornadoes can uproot trees, bring down power lines and destroy buildings.

Severe Storm &Tornado Experience and Probability

According to "Florida Hazardous Weather, a Preparedness Guide," published by the Florida Department of Community Affairs, most tornado deaths occur during the fall, winter, and spring seasons when stronger dynamics are present in the atmosphere capable of producing 'supercell'/mesocyclone thunderstorms." The Wind Speed Maps generated through the TAOS model show an equal distribution of winds over the entire area of the Keys for each storm scenario. This demonstrates that the low-lying terrain and narrow islands do not appreciably slow onshore winds.

Based on the NCDC online database, between 1950 and late 2004, numerous events with winds between 50 and 85 knots were reported. Property damage over the 54 year period was reported at less than $30,000 (not verified) and one death occurred after a boat was capsized.

Florida leads the nation in lightning deaths and injuries, with most occurring from May to October (peaking in July). People near water appear to be at greater risk. Because the Florida Keys are surrounded by water and most tourism and recreation activities are water-based, lightning is a significant hazard (Table 6-2).

Table 6-2. Lightning Deaths/Injuries for Monroe County (1959-2005)

Date	Death	Injury	Remarks
September 1959	0	1	Bridge tender
October 1962	0	1	Unknown
June 1974	1	0	Trash collector in vehicle
July 1976	1	1	Fishing boat
August 1980	1	0	Fishing from bridge
September 1982	1	1	Snorkeling
June 1983	1	0	Fishing from bridge

Table 6-2. Lightning Deaths/Injuries for Monroe County (1959-2005)

August 1986	0	1	Standing under tree
August 1990	0	1	Fishing from boat
July 1995	0	1	Police officer next to car
July 1997	0	1	Unknown
July 2000	0	1	Fishing boat
August 2001	0	1	Restaurant employee
Total	5	10	
Average of 0.1 deaths and 0.2 injuries per year			

Source: NWS Warning Meteorologists, Miami & Key West

Half of tornadoes in Florida occur in the summer months from May through August, but only less than 10% of tornado-related deaths happen during this period of time. Most tornado deaths occur during seasons when stronger atmospheric dynamics may produce supercell/mesocyclone thunderstorms.

Table 6-3 summarizes tornadoes that affected Monroe County from 1959 to 1995 and Table 6-4 lists detail on tornadoes that hit the area between 1996 and 2004. During the 45 year span reflected in the two tables:

- A tornado of intensity F0 or F1 occurs, on average, about once each year; and
- F2 tornadoes, much rarer with only 4 reported associated with two hurricanes, caused most injuries and, by far, the most property damage.

Table 6-3. Tornadoes: 1959 - 1995

Fujita Scale	# Tornadoes Reported	Deaths	Injuries	Cumulative Damage (not adjusted)
F-0	22	0	0	$153,000
F-1	14	0	11	$1,058,000
F-2	2	0	40	$742,000 (both associated with Hurricane Agnes in June 1972

Table 6-4. Tornadoes: 1996 – 2004

Location Affected	Date	Fujita Scale	Deaths	Injuries	Damage
Key Largo	May 1996	F-0	0	0	

Table 6-4. Tornadoes: 1996 – 2004

Location Affected	Date	Fujita Scale	Deaths	Injuries	Damage
Grassy Key	May 1997	F-1	0	0	$150,000
Long Key	August 1997	F-0	0	0	
Duck Key	September 1997	F-0	0	0	
Marathon	February 1998	F-1	0	0	$20,000
Islamorada	February 1998	F-0	0	0	
Key West	June 1998	F-0	0	0	$15,000
Islamorada	November 1998	F-1	0	0	$100,000
Rock Harbor	November 1998	F-2	0	0	$50,000
Key Largo	November 1998	F-2	0	20	$25 mil
Key West	May 1999	F-0	0	0	
Rick Harbor	September 1999	F-0	0	0	
Craig Key	October 1999	F-1	0	0	
Key West	October 2000	F-0	0	0	
Big Pine Key	July 2000	F-0	0	0	$15,000
Big Pine Key	August 2000	F-0	0	0	
Key West	October 2003	F-0	0	0	

Source: NCDC online; NWSKW Warning Meteorologist

Exposure to Tornado*

Population: 79,589
Residential: $9.3 million
Commercial: $2.1 million

Annualized Losses from Tornado **

Total Losses: $1.7 million

Tables 3.3.7* & 3.5.3**
Florida State Hazard Mitigation Plan (2004)

A significant non-tropical weather event that affected Monroe County was the "Storm of the Century," a severe, mega-winter storm that occurred from March 12-23, 1993. Moving from Florida's West Coast across the state and up the eastern seaboard, the storm eventually wreaked havoc from Florida to New England. It brought heavy rains, wind, and coastal flooding to the Southeast and blizzard-like conditions in the Northeast. When it was finally over, the total damage estimates were over $800 million (over $200 million in Florida). The Florida Keys experienced high winds and tides and substantial amounts of rainfall and the County was among the 38 counties declared a Presidential disaster area.

A particularly active year was 1998, The first event of that year, referred to as the "Ground Hog's Day Storm," occurred on February 2, 1998 and involved multiple tornado

touchdowns resulting from severe thunderstorms characterized by dangerous cells with high, cold cloud tops. Areas most affected were the Middle Keys including Grassy Key and Valhalla Beach in the vicinity of Duck Key. Several buildings were damaged. Also significant problems occurred from the displacement of lobster traps which contributed to seaborne debris and navigational problems. The fishing industry suffered considerable loss of income.

Another significant weather event occurred on July 4, 1998, when severe thunderstorms with lightning and high winds came up quickly in the Middle Keys. The Key West Weather Service Office recorded sustained wind speeds up to 70 mph. Because it was July 4th, many boats were offshore celebrating and waiting for fireworks displays. One boat capsized, resulting in a fatality. This storm did not prompt a major disaster declaration.

The most damaging tornadoes in 1998 were spawned by Tropical Storm Mitch on November 4 and 5. Islamorada experienced an F-1 tornado, while Rock Harbor and Key Largo were hit by F-2 tornadoes. One tornado moved at 30 mph, tearing down utility lines, damaging boats, and damaging more than 600 structures, many of them were mobile homes.

[XX *Request County GIS if locations of Mobile Home/RV Parks can be plotted: Monroe County Property Appraiser's Office (Robbie Shaw) identified 109 Mobile Home/RV Parks and 6,100 individual Mobile Home parcels.*

6.4 Rainfall/Fresh Water Flooding

Flooding due to the accumulation of rainfall generally is not a problem in most of Monroe County and the municipalities because the underlying coral rock and limestone soils have high infiltration rates. The exceptions to this are:

- The City of Key West does experience some freshwater flooding when storm drains cannot handle the volume of runoff and the excess flows through the streets; some low areas do not drain well, resulting in ponding.
- The City of Marathon has identified several locations where ponded water causes access problems and can affect older, non-elevated, buildings.

The most significant rainfall/fresh water flooding event occurred on November 11-12, 1980. The storm resulted in $1 million in property damage, primarily in the City of Key West. The storm, known as the "Veteran's Day Storm," resulted from the influence of a stalled cold front and Tropical Storm Jenne that was over Cuba. These combined systems produced 23 inches of rain in 24 hours, the heaviest 24-hour rainfall ever recorded for the area. Even

though the water was pouring out into the neighboring oceans, the intense rainfall resulted in widespread flooding especially in streets and low-lying areas. Weather Service reports indicated that 300 vehicles and 500 buildings were seriously damaged.

Monroe County Public Works reports that runoff from intense rainfalls generally does not result in road or drainage swale damage, although some unpaved roads exhibit washing and potholes.

6.5 Drought

The 1998 Monroe County Comprehensive Emergency Management Plan defines drought as "a prolonged period of dry weather during which there is an inadequate supply of water to meet water demands." It continues that, "this prolonged lack of water can have severe effects on people animals, and plants." It is noted that this situation could result in massive impact to life and property and could severely affect commerce. "Lack of rainfall and adequate water supply could result in health problems for humans, animals, and vegetation. Regulations and water restrictions may force residents to stop the waste of any potable water or water supply". Drought may be accompanied by prolonged periods of extreme heat.

Drought is a natural and expected part of the climate in most areas, but the severity of drought impacts differs based on duration, geographic extent, intensity, human demand for water, and agricultural practices. Drought can be defined as:

- Meteorological drought, an extended period of dry weather.
- Agricultural drought, a shortage of precipitation that affects crops.
- Hydrologic drought, a reduction in water content in lakes, rivers, streams, aquifers, and soils that may affect supplies available for all users.

The Florida Keys are normally characterized by an arid climate and native vegetation is acclimated to such conditions. However, human usage of potable water continues to rise as development occurs. Situations requiring water usage restrictions have occurred over the last several years:

- The City of Key West imposed water restrictions in November 1990.
- The City of Layton operated under water restrictions in the mid-1990s.
- In 2001 the South Florida Water Management District imposed Phase 1 and Phase 2 water restriction rules throughout the Keys.

Using a simplified approach of occurrence over a given period, for the ten-year period of the 1990s the frequency of drought was 20%. This statement of frequency does not imply severity. Indeed, the Key West Weather Service indicated that drought periods in the Keys

have not been prolonged or widespread and thus drought is not considered to be a significant hazard for Monroe County.

The County is supplied with water from the mainland and all residents are very aware of the need for water conservation on a regular basis, not only during announced drought periods. Typical usage is 169 gallons per person per day during tourist season and 96 gallons per person per day off-season. Measures such as encouraging native vegetation and using native ground cover vegetation in place of lawns contribute to reducing water consumption. Compared to other counties in South Florida, Monroe County's per capita water use is at or below average in most areas.

6.7 Wildland Fire

Wildland fires are defined as an uncontrolled fire spreading through vegetative fuels that exposes and possibly destroys buildings. Wildfires are classified as either wildland (in relatively undeveloped areas, perhaps with some basic infrastructure such as roads, power lines, and railroads) or an urban-wildland interface fire (areas with buildings and development).

Certain conditions must be present for a wildland fire hazard to exist: a large source of fuel; conductive weather (generally hot, dry, and windy) and lack of fire suppression capability due to remoteness or other limitations.

The Monroe County Comprehensive Emergency Management Plan notes that the threat of brush and wildland fires is minimal for the majority of Monroe County. The exceptions are the Everglades National Park in mainland Monroe, and on Big Pine and Sugarloaf Keys in the Lower Keys.

A primary cause of fires is arson, especially vandalism by school age children. Other factors that contribute to fires are high winds and droughts, lightening, carelessness, and accidents. Problems can also occur, especially in storms when downed utility lines may spark fires. Accumulated debris after hurricanes contributes to overall fire potential, including wildland fire potential. After Hurricane Georges in 1998, brush debris caught fire in Big Pine.

Information provided the Florida Department of Forestry indicates that while wildland and brush fires occur infrequently and with little significant consequence in Monroe County, they may occur more often than many think. However, most fires are small and contained quickly. On rare occasion, incidents are more serious. For the most part, fires in the

Everglades do not threaten residential properties although heavy smoke can lead to road closures. Some notable recent events include:

- In the early 1990s, wildfire on No Name Key threatened a few homes.
- Due to very dry conditions, a fire on Big Pine Key in mid-1999 involved 7 acres; although some residences are located in the affected area, no homes were lost.
- Big Pine Key's 2002 wildfire outbreak reached about 6 acres in size and several homes were evacuated.
- A 2003 wildfire in Cudjoe Acres threatened several homes.

The Department of Forestry reports that areas prone to wildland and brush fires in Monroe County include Everglades National Park, No Name Key, Big Pine Key, Grassy Key, Sugarloaf Key, Cudjoe Key, and Big Coppitt Key (including Geiger and Boca Chica). As an indicator of at-risk property in these areas, Table 6-XX indicates the total number of platted lots, the number of lots with improvements, and the value of those improvements. It is important to note that this summary of all properties is not to imply that all properties would be vulnerable in any given wildfire outbreak.

Table 6-5. Summary of Wildfire Risk Areas*

Area	Total # Parcels	# Improved Parcels	Value of Improvements*
Mainland/Everglades	13,736	39	$1,987,917
No Name Key	504	43	$8,961,524
Big Pine Key	8,929	2,741	$444,130,421
Sugarloaf Key	2,284	1,033	$252,653,244
Cudjoe Key	2,952	1,521	$251,845,233
Big Coppitt Key (including Geiger and Boca Chica)	2,627	1,289	$258,465,919
Grassy Key (in Marathon & Key Colony Beach)	9,391	6,498	$1,562,786,704

* Data from Monroe County Property Assessment (June 2005)

Existing Mitigation Measures. Monroe County has a program for training and certifying volunteer fire departments in wildland fire fighting. Although, the Department of Forestry in the Keys received new equipment in the late 1990s, staff levels have been reduced to only two rangers for all of Monroe County. The following preventive measures are recommended by the Department of Forestry:

- Educational programs, especially for children.

- Clearing of brush, particularly vegetation close to buildings.
- Cleaning gutters to prevent build-up of burnable materials.
- Timely disposal of yard waste and household debris, particularly mattresses.
- Development of ordinances dealing with removal of brush and potentially dangerous vegetative materials, especially during dry spells and during hurricane season, and rapid removal of storm debris.
- When residential property is threatened by fire, the roof and yard should be wet down to provide protection.

To deal with wildfire threats on Cudjoe Key, the Florida Division of Forestry added water supply wells and widened some roads to improve emergency vehicle access.

6.8 Overview of Monroe's Hazards & Risks

The descriptions of hazards, hazard histories, and impacts are summarized as "relative" vulnerabilities in Table 6-6.

Table 6-6. Hazards: Relative Vulnerability

Hazard	Vulnerability	Impact	Frequency	Distribution
Hurricane/Tropical Storm	High	Moderate to Severe	1-2 per year	Countywide
Flooding (rainfall ponding)	High (locally)	Moderate	6-12 times each year	Key West & Marathon
Tornado	Moderate	Moderate	1-2 per year	Countywide
Wildfire	Moderate	Moderate	Less than 1 per year	Selected areas
Drought	Low	Low	1-2 per decade	Countywide

Chapter 7: Monroe County

This chapter contains an overview of Monroe County agencies and their functions as they relate to natural hazards and hazard mitigation. This plan does not characterize functions dealing with emergency response and immediate post-event recovery. That information is found in the Monroe County *Comprehensive Emergency Management Plan.*

Chapters 8 through 12 describe the cities Key West, Marathon, Key Colony Beach, Layton, and Islamorada Village of Islands.

7.1 County Government Structure

Monroe County, created in 1824, is a political subdivision of the State of Florida. The powers and authority of the County emanate from the State Legislature.

The Board of County Commissioners (BOCC), which performs the legislative and executive functions, consists of five members elected at large. Each commissioner represents one of five districts and is elected for a term of four years. Pursuant to Florida Statute 252, the BOCC is responsible for safeguarding the life and property of the population of Monroe County, and to provide effective governmental control and coordination of emergency operations. The Monroe County *Comprehensive Emergency Management Plan* details the emergency responsibilities of the BOCC and the myriad procedures that flow from those responsibilities. Emergency responsibilities include:

- Declaring states of local emergency,
- Issuing emergency orders and recommendations,
- Setting policy, providing guidance to the Incident Commander, and
- Authorizing the issuance of protective action recommendations.

The primary objective of the County's emergency planning and response functions is to protect public safety, and virtually every department has preparedness, response and recovery responsibilities that are outlined in the County's emergency plans (Emergency Support Functions). In contrast, the primary objective of mitigation is to reduce risks and damage due to natural hazards.

For administrative purposes and to conduct the work of the County, the BOCC has organized the County into five functional divisions each with several departments (Table 7-1). Selected departments that have direct or indirect roles in addressing natural hazards are described below.

Table 7-1. Monroe County's Functional Divisions

Division	Departments Supervised	Mitigation Role		
		Direct	Indirect	None
County Administrator	Airport Services			✓
	Fire Rescue Services		✓	
	Veterans Affairs			✓
Public Safety	Emergency Management	✓		
	Communications			✓
	Solid Waste		✓	
	Marathon Airport			✓
Public Works	Engineering	✓		
	Facilities Maintenance	✓		
	Fleet Management			✓
	Roads and Bridges	✓		
	Card Sound Toll Authority			✓
	Animal Control			✓
Growth Management	Planning & Environmental Resources	✓ ✓		
	Building Code Enforcement		✓	
	Marine Resources		✓	
	GIS/Maps		✓	
Community Services	Social Services		✓	
	Library Services			✓
	Extension Services			✓
Management Services	Administrative Services	✓		
	Technical Services	✓		

7.1.1 County Administrator/Department of Emergency Management

The County Administrator implements the policies of the Commission and administers the overall operations of the County. The Administrator serves as Director of Management Services and:

- May participate in conducting analyses and providing recommendations to the BOCC for hazard mitigation options, including relocation and reconstruction of damaged public facilities.
- Participates in intra and inter-governmental disaster planning efforts.
- Participates in post-disaster assessment and may develop mitigation initiatives to address reduction of future loss.

- Oversees the Grants Manager in the Hazard Mitigation Grant Process.
- Reviews 406 hazard mitigation components of the federal Public Assistance Program.

Chapter 252.38 of the Florida Statutes requires political subdivisions to develop emergency plans to provide for the safeguarding of life and property of its citizens. Emergency management agencies have jurisdiction over and serve an entire county, including the elements of preparedness, response, recovery, and mitigation. The Monroe County Department of Emergency Management prepares the documents required to carry on its program including the Comprehensive Emergency Management Plan, Hurricane Evacuation, Shelter, and Refuge of Last Resort Plan, Turkey Point Nuclear Power Plant Emergency Plan, and numerous other plans and procedures. Included among the Department's many activities are the following:

- Emergency Management is the primary department responsible for training and public awareness as it relates to disaster preparedness; throughout the year, personnel conduct seminars and presentations, regarding emergency preparedness.
- Emergency Management conducts an annual training program for all county departments (including Volunteer Fire Departments), agencies (including the American Red Cross and Salvation Army) and personnel which includes, but is not limited to EOC operations, departmental and personnel preparedness.
- Monroe County Emergency Management has established a number of public information and education programs regarding recovery efforts and available assistance.
- Hurricane preparedness information concerning Mobile Home, Travel Trailer and RV Hurricane Procedures and local shelter information, , is disseminated to the public via local television, radio and print media each year prior to Hurricane Season.
- Emergency Management personnel, as part of their professional development, are encouraged to attend State and FEMA courses.
- Local personnel are trained through programs of relief organizations (ARC, Salvation Army or HAM Radio).
- Monroe County conducts annual drills and exercises in, but not limited to, hurricane response, nuclear power plant response, airport disaster response, mass migration, cruise ships emergencies, and oil spill response. These exercises are usually scheduled in conjunction with the State Division of Emergency Management, and various County, state, and federal agencies.
- All agencies that would be responding in an actual event participate in annual exercises and drills. Drills and exercises test emergency systems such as the Emergency Alert System, HURREVAC, HURRTRAK, ESATCOM, Inland

Wind Storm Tracking/Damage Assessment Systems (TAOS), as well as SLOSH modeling software (Sea Lake Overland Surge from Hurricanes).

The Monroe County Department of Emergency Management is charged with facilitating, developing, managing, monitoring and evaluating the Monroe County Local Mitigation Strategy Plan, in cooperation with the municipalities of Key West, Marathon, Key Colony Beach, Layton, and the Village of Islamorada. The agency coordinates with the Florida Department of Community Affairs to process applications for mitigation grant funds.

Projects funded with hazard mitigation funds, including funds that may be made available as part of FEMA reimbursements for damage to public facilities, must conform to established Monroe County codes and regulations.

7.1.2 Growth Management Division

The Growth Management Division recommends and implements policies provided in the County's Comprehensive Plan and the Land Development Regulations. The Building, Planning, and Zoning Department is under the Division's jurisdiction. Planning staff assists in the development of the County's Comprehensive Plan.

The Building, Planning, and Zoning Department is responsible for reviewing construction plans, issuing building permits, and inspecting projects during construction. Enforcement of zoning and building standards are intended to safeguard public safety and to minimize damage associated with high winds and flooding. Table 7-1 shows totals for permits issued between January 1, 1999 and December 31, 2004 (along with annual averages). The Division serves as the coordinator for the National Flood Insurance Program and assists the public in identifying and implementing flood damage prevention measures.

Monroe County, Florida

- *Seven Inspectors*
- *Two Inspectors hold minimal standard certifications and five Inspectors are cross certified in each trade; plumbing, mechanical electrical and structural*
- *BCEGS rating:*
  - *3 for 1-2 Family Dwellings*
  - *3 for Commercial*

Table 7-1.

Permits Issued Between January 1, 1999 and January 31, 2004

Activity	Total (average)
New single-family, detached	930 (230/yr)
Multi-family (2 or more)	852 (210/yr)
Non-residential (all types)	98 (25/yr)
Residential (additions, alterations, repairs)	6,561 (1,640/yr)
Non-residential (additions, alterations, repairs)	899 (225/yr)
Demolition	439 (110/yr)
Mobile home (permanent/temporary)	3 (1/yr)
Total	9,782 (2,445/yr)

Source: Monroe County Building Department

Post-damage inspections are conducted to determine requirements that are applicable during repair and reconstruction. After a hazard event that prompts recovery, the Growth Management Division carries out the following specific duties:

- Collection of information for preparation of Damage Survey Reports is a joint effort of MC Emergency Management and MC Growth Management. The MC Growth Management Division surveys neighborhoods for structural damage. For the purpose of re-construction, damage to structures is categorized by "minor", "major", "uninhabitable" (major electrical, plumbing or roof damage), and "destroyed".
- For substantially damaged buildings that also are insured by the NFIP, the Growth Management Division issues letters for application of Increased Cost of Construction (ICC) claims and requires re-construction through the permitting process to comply with all current codes.
- Mitigation activities in post-disaster situations will be handled through the Growth Management Division and the Department of Emergency Management.
- Planning Department policies ensure that mitigation related items in the Comprehensive Plan, such as floodplain and natural resource management, are followed and reflected in the County's Codes and Standards.
- Planning personnel participate in post-disaster appraisals and may formulate additional mitigation measures for use in the Comprehensive Plan. Personnel work closely with building and zoning staff to ensure coordination.
- Mitigation recommendations, especially those based on direct disaster experience will be reflected in the Evaluation and Appraisal Reports (EAR) required for the Comprehensive Plan.

- Environmental Resources monitors environmental provisions in regulations, codes, and plans and coordinates with other agencies as needed.

7.1.3 Public Works Department

The Public Works Department is responsible for overseeing the maintenance and operation of County facilities, including roads and bridges. From three locations (Key West, Marathon, and Plantation Key), the department operates and maintains the County's heavy equipment, vehicles, repair shop, and fueling stations. The County's engineering operations function under the Public Works Department.

The Public Works Department is responsible for the following disaster and mitigation-related activities:

- Deploy protective measures at County's designated Shelter facilities (i.e., install shutters, position generators, etc.).
- Expedite debris clearance of Overseas Highway (US #1).
- Allocate, prioritize, and coordinate public and private transportation resources for the conveyance of goods, materials, and services within the affected areas.
- Assist with re-entry and respond to assistance requests from municipal agencies.
- Conduct initial or preliminary assessments to provide early estimates of damage.
- Secure environmental waivers and legal clearances for debris removal and disposal.
- Identify and report damage to public facilities and infrastructure, participate in preparation of documentation for State and federal reimbursements, and consider possible mitigation measures as part of repairs and reconstruction.
- Establish priorities regarding the repair and/or reconstruction of damaged transportation routes (roads, bridges, airfields, etc.).
- Plan, coordinate and initiate restoration of the serviceability of transportation routes, bridges.
- Assist with inspection of damaged private buildings to determine stability, level of damage, and safety with respect to reoccupation.
- Coordinate emergency contracting and emergency repair of drainage and solid waste facilities.

7.1.4 Division of Public Safety

The Division of Public Safety has administrative responsibility for Waste Management, Communications, the Marathon Airport, and the Office of Emergency Management.

Monroe County Fire/Rescue, is comprised of Emergency Medical Services, and the County Fire Marshall's Office. During an emergency these agencies are responsible for firefighting, medical services, and urban search and rescue.

The Division of Public Safety (and its functional units) is responsible for the following disaster-related activities:

- Manage the Emergency Operations Center
- Coordinate with local hospitals
- Coordinate Special Medical Needs
- Coordination with Monroe County School Board
- Manage shelters
- Coordinate with the Florida Department of Forestry, U.S. Navy, Boca Chica, Florida Marine Patrol, and other fire service resources to support emergency functions requiring fire-fighting capacity to perform emergency response, recovery and assistance missions.
- Coordinate search and rescue operations and resources; provide support to local agencies' locate missing persons, lost vessels, persons trapped in confined areas (including damaged/destroyed structures); locate downed aircraft, extricate, if necessary, and treat victims upon rescue.
- Monroe County Emergency Medical Services is responsible for reviewing and assessing health and medical needs of the county in the event of an emergency event and obtain resources to meet needs.
- Fire Marshall's Office coordinates and directs efforts to complement local emergency response actions in the aftermath of a hazardous material accident/incident; secures affected areas and coordinates removal and disposal of materials from the disaster location.

7.1.5 Monroe County Health Department

The Monroe County Health Department is an agency of the State that functions as the primary public health unit for the county and municipalities. The department's responsibilities include investigating and addressing public health threats, dealing with reportable and non-reportable diseases and environmental issues, regulation of biomedical waste, radiological incidents, child care facilities sanitation inspection, septic tank permitting, regulation of toxic and hazardous materials, locating/installing fuel storage tanks, and permitting of mobile home and RV parks. The Health Department operates from three locations in the Upper, Middle, and Lower Keys. Each office oversees health issues such as rabies and infectious disease control, and family planning and health services.

The Health Department is responsible for the following disaster-related activities:

- Disaster Community Health Assessment Teams conduct post-disaster assessments of public health risks.
- Following a disaster, the Health Department maintains surveillance of outbreaks of infectious diseases and takes necessary actions to address problems.
- May undertake event-specific activities; after Hurricane Georges the department reviewed performance of various kinds of septic and waste systems.
- Is responsible for the sheltering needs of the area's Special Needs Population in both in-county and out-of-county hurricane sheltering operations.

7.1.6 Monroe County Management Services

Management Services includes the Office of Management and Budget, the Purchasing Department, and the Finance Department. The day-to-day financial management and satisfying fiscal requirements, including grants management functions are overseen by Management Services.

Management Services is responsible for the following disaster-related activities:

- Assist all departments and maintain thorough documentation of disaster-related expenditures, the key element in the reimbursement process which requires maintenance of logs, records and file copies of all expenditures in order to provide clear accountability for reimbursement requests.
- To reduce confusion and expedite the supply process during an emergencies, establishes pre-arranged contracts with vendors.
- Establishes financial management procedures in conformance with State and federal requirements specific to funding sources.

7.1.7 Monroe County School Board

The Monroe County School Board operates and maintains the school system in the County and municipalities. In addition to serving the student population, schools are a vital component of the County's Emergency Management Program. Selected school buildings may function as shelters, school personnel often serve as shelter staff, school buses are used in evacuations, and school personnel provide shelter support services.

The Monroe County School Board's mitigation and response activities include:

- The Board's construction standards among the strictest in the State; new construction is required to meet 150 mile per hour wind-load standards.

- The Board and school system is a participating member on the Local Mitigation Strategy Working Group.
- The Board and Monroe County government cooperate in many emergency-related efforts, including applying for grant funds to install hurricane shutters on several schools used as shelters. [XX *Which schools were retrofitted (and source/amount of funds)*]
- A Generator Shelter Retrofit Grant is to be submitted in 2005; the schools will be Key West High School, Sugarloaf Elementary, Switlik School, Coral Shores High School, Key Largo Elementary, and the St. Justin's the Martyr Catholic Church.

7.2 Regional Agencies & Organizations

7.2.1 South Florida Regional Planning Council

The South Florida Regional Planning Council plans for and coordinates activities of the South Florida Region (Broward, Miami-Dade, and Monroe Counties). State legislation passed in 1993 recognized that the regional planning councils are Florida's only multi-purpose regional entities that are in a position to plan for and coordinate intergovernmental solutions to growth-related problems on greater-than-local issues.

Regional planning councils are required to develop Strategic Regional Policy Plans. Emergency Preparedness is one of the six strategic subject areas addressed and goals and policies contain provisions relating to hazard mitigation. In addition, the other strategic areas (land use and public facilities, natural resources, economic development, transportation, and emergency housing), may provide recommendations related to mitigation. The Plan recognizes the critical link between land use and emergency preparedness. For example, management of growth in the region relates directly to emergency evacuation. Preservation of the environment reduces development or guides development in ways that maintain important natural areas that may buffer the effects of storms and other hazards.

The South Florida Regional Planning Council's mitigation and response activities include:

- During the development process for the Strategic Regional Policy Plan, the South Florida Regional Planning Council held workshops with regional agencies to acquire input. An Emergency Preparedness Workshop which included discussion of mitigation issues was held and provided an opportunity to interested agencies to identify their concerns and needs relating to mitigation.
- In its review of documents such as County Comprehensive Plans and Comprehensive Emergency Management Plans, the South Florida Regional Planning Council can recommend policies that enhance hazard mitigation.

- The South Florida Regional Planning Council conducts other projects that directly assist in effective emergency management and hazard mitigation, such as publication of the "Hurricane Survival Guide for Small Businesses, September 1995".

7.2.2 South Florida Water Management District

The South Florida Water Management District, operating under the jurisdiction of the Florida Department of Environmental Protection, is responsible for overseeing the very complex system of waterways and canals that affect the water system throughout much of South Florida.

The Florida Keys of Monroe County does not contain a system of drainage canals under the supervision of the Water Management District, as do other counties. However, portions of the County on the mainland that are located in Everglades National Park and Big Cypress Basin are under the District's control. The County and incorporated municipalities may coordinate with the District to develop Storm Water Management Master Plans and policies to improve storm water management techniques and participation in the Surface Water Improvement Management Program.

The South Florida Regional Planning Council's mitigation and response activities include:

- The South Florida Water Management District analyses and recommends water control measures to mitigate hazards such as floods and droughts.
- Implementation of storm water management measures advocated by the District, such as discouraging the use of impervious surfacing and filling and retention of natural drainage patterns and open space, could help decrease property damage from a major storm event.
- Through the planning and use of various water control techniques, the District's work can mitigate certain hazards such as those related to flooding and the mixing of fresh and salt water.

7.2.3 Florida Keys Aqueduct Authority

The Florida Keys Aqueduct Authority is an independent agency constituted by the State of Florida with the primary purpose and function to obtain, supply, and distribute an adequate water supply to the Florida Keys. The Authority manages the infrastructure used to supply water to the Florida Keys and provides service to the consumer, sets rates, and conducts billing.

The Florida Key's Aqueduct Authority's mitigation and response activities include:

- The Authority's pipeline originates in Florida City in south Miami-Dade County. It examines ways to protect the supply system from hazards and minimize the opportunities for disruption. After Hurricane Andrew in 1992, power failures in Homestead suspended pumping and prevented the flow of water to the Keys. The Authority works to find ways to deal with disruption, including identification of alternative sources when water cannot be supplied through the pipeline.
- The Authority participates in developing policies and procedures for responding to and recovering from shortages and disruptions in the supply and delivery of electricity, potable water, and other forms of energy and fuels which affect or threaten to affect significant numbers of citizens and visitors.

7.2.4 Electric Utilities

The electric utilities that serve Monroe County are the Florida Keys Electric Cooperative (FKEC), the Key West City Electric System (KWCES), and Florida Power and Light (FP&L). The mitigation and response activities of the utilities include:

- Establish policies and procedures for responding to and recovering from shortages and disruptions, including the supply and delivery of electricity, potable water, and other forms of energy and fuel, which affect or may affect significant numbers of citizens and visitors.
- Restoration of utility services which were interrupted due to major or catastrophic emergencies. Coordination of services and communications among utilities and local, state and federal agencies. Identification of emergency-related problems and development of remedial actions.

7.3 Planning & Development Processes

7.3.1 Comprehensive Plan: Year 2010

The Monroe County Comprehensive Plan (Year 2010) consists of three parts: the Policy Document; the Technical Document; and the Map Atlas. The Policy Document contains the goals, objectives and policies for each element, the capital improvements implementation program, and the monitoring and evaluation procedures. The Technical Document contains background information and support data and analyses for the elements of the plan. The Map Atlas contains maps depicting background information for the various elements (existing land use, natural features, existing, transportation, etc.). The County's commitment to implementing the Comprehensive Plan is "limited to its reasonable ability to fund only part of the cost of implementation." It is acknowledged that external funding is required for full implementation.

The Comprehensive Plan is framed as a series of goals, objectives, and policies that are organized under fourteen elements. Natural hazards, especially flooding and high winds associated with hurricanes and coastal storms, stormwater and drainage, and drought are incorporated throughout. The following are some of the more notable citations:

- **Goal 101:** Monroe County shall manage future growth to enhance the quality of life, ensure the safety of County residents and visitor, and protect valuable natural resources.
  - **Objective 101.2:** Monroe County shall reduce hurricane evacuation clearance times to 24 hours by the year 2010. This policy is implemented through the Permit Allocation System and consideration of the new hurricane evacuation transportation model in consideration of capital improvements.
  - **Objective 101.5:** Monroe County shall implement a Point System which directs future growth to encourage redevelopment and renewal of blighted areas, to maintain and enhance the character of the community, to protect natural resources, to encourage a compact pattern of development, and to encourage affordable housing.
  - **Objective 101.9:** Monroe County shall provide for drainage and stormwater management so as to protect real and personal property and to protect and improve water quality.
  - **Objective 101.14:** By January 4, 1997, Monroe County shall adopt Land Development Regulations which direct future growth away from areas subject to periodic flooding (with particular focus on the Coastal High Hazard Areas, in which mobile homes shall be prohibited except in existing parks or subdivisions).
- **Goal 102:** Monroe County shall direct future growth to lands which are intrinsically most suitable for development and shall encourage conservation and protection of environmentally sensitive lands.
  - **Objective 102.8:** Monroe County shall take actions to discourage private development in areas designated as units of the Coastal Barrier Resources System, including discouraging extension of facilities and services by providers of electricity and telephone service.
- **Goal 206:** The health and integrity of Monroe County's beach/berm resources shall be protected and, where possible, enhanced (through development standards for siting structures, disturbances, setbacks, restoration of native vegetation).
- **Goal 211:** Monroe County shall conserve and protect potable water resources and cooperate with regional efforts to ensure the continued availability of quality potable water.
  - **Objective 212.2:** Monroe County shall adopt minimum performance standards designed to reduce the stormwater runoff impacts, aesthetic impacts, and hydrologic impacts of shoreline development.
  - **Objective 212.**3: Permitted uses and performance standards within the shoreline setback are outlined.
- **Goal 216:** Monroe County shall provide for hurricane evacuation, shelters and refuges, and communication capabilities to promote safeguarding of the public against the effects of hurricanes and tropical storms. Among policies outlined are consideration of impact fees to offset the public costs of hazard mitigation, evacuation, reconstruction of public facilities, emergency communications

equipment, and similar needs (Policy 216.1.15) and inclusion in the Post-Disaster Recovery Plan a structured procedure aimed at debris removal preparedness during hurricane evacuation and re-entry (Policy 216.1.14).

- **Goal 217:** Monroe County shall develop and implement a program of hazard mitigation and post-disaster redevelopment to increase public safety and reduce damages and public expenditures.
  - **Objective 217.1:** Monroe County shall develop and implement a program of hazard mitigation in the Coastal High Hazard Area which reduces floodplain alteration and damage or loss due to natural disasters. Policies address new or replacement sanitary sewage systems, supply of potable water, review of the building code, participation in the NFIP's Community Rating System, enforcement of setback and elevation requirements, and public acquisition decisions.
  - **Objective 217.2:** Monroe County shall develop a Post-Disaster Redevelopment Plan which addresses priorities for immediate recovery and long-term redevelopment including reducing exposure of human life to natural hazards. Policies address coordination of post-disaster recovery operations, damage infrastructure, FEMA-designated V Zones and repetitive loss areas, and limits on certain redevelopment.

- **Goal 701:** Monroe County shall support the Florida Keys Aqueduct Authority in the fulfillment of their statutory obligation and authority to provide for a safe, high quality and adequate supply, treatment, distribution, and conservation of potable water to meet the needs of present and future residents. Objectives include water conservation efforts.
- **Goal 1001:** Monroe County shall provide a stormwater management system which protects real and person properties, and which promotes and protects ground and nearshore water quality.
- **Goal 1301:** Monroe County shall promote and encourage intergovernmental coordination between the County, the municipalities, the counties of Dade and Collier, regional state and federal governments and private entities in order to anticipate and resolve present and future concerns and conflicts.
- **Goal 1401:** Monroe County shall provide and maintain, in a timely and efficient manner, adequate public facilities for both existing and future populations, consistent with available financial resources and the other elements of the Comprehensive Plan. Considerations include elimination of public hazards, with limitations on public expenditures within the Coastal High Hazard Area.

7.3.2 Floodplain Management

Monroe County administers the Floodplain Management Ordinance to regulate development within areas designated by National Flood Insurance Program (NFIP) as "areas as of special flood hazard." The purpose is to "protect the public health, safety and general welfare and to minimize public and private losses due to flood conditions". Areas of special flood hazard

are identified as those expected to be inundated by the 1%-annual chance flood (commonly called the "100-year flood").

Special flood hazard areas are specified as "A/AE Zones" where waves are expected to be less than 3-feet high and V Zones where high velocity wave energies are expected. Most of the County's land area is subject to flooding. The FIRMs show the anticipated flood elevations (referenced to mean sea level).

NFIP Flood Insurance Policies in Monroe County: 21,728

Claims paid since 1978: 3,676*

http://www.fema.gov/nfip/pcstat.shtm
(as of December 31, 2004)

*includes properties now in Marathon

The County's Floodplain Management Ordinance specifies standards for residential and non-residential construction and water supply and sanitary sewer systems that are located in areas of special flood hazard. It prohibits the alteration of sand dunes, mangrove stands or wetlands if such alterations would increase the potential for flood damage. Placement of fill and obstructions is discouraged (structural fill is prohibited in V Zones).

Standards are set forth for residential, non-residential, and manufactured (mobile home) developments in special flood hazard areas. The dominant standard requires that the lowest floor of buildings (including manufactured homes) be elevated to or above base flood levels. Enclosures below the elevated lowest floor are allowed only if they meet requirements specific to the flood zone.

Enclosures Below Elevated Buildings

In 1995, FEMA notified Monroe County that the illegal conversion and occupancy of enclosures below elevated residential structures had resulted from a deficiency in the County's enforcement of its floodplain management regulations. The County was directed to correct the deficiency or face suspension from the National Flood Insurance Program.

The Board of County Commissioners responded by appointing a task force to address the problem, which is complicated by the fact that Florida law prevents on-site investigations. The task force, working with the State and FEMA, developed the concept that evolved into the "Flood Insurance Inspection Program." For the five-year period of 2002 to 2007, NFIP-insured homes with enclosures below the Base Flood Elevation must be inspected to identify deficiencies and deficiencies must be corrected in order for flood insurance policies to be

written. As of mid-2005, over 600 properties had been inspected and nearly 500 had been brought into compliance.

Section 9.5-319 of the County's Floodplain Management Ordinance requires the County to provide an "inspection upon Transfer of Property." A report is provided to the new owner regarding any non-conformities associated with enclosures.

NFIP Repetitive Loss Properties

Data provided by the Florida Department of Community Affairs identifies properties that are, or have been, insured by the National Flood Insurance Program and that have received two or more claims of at least $1,000. Within unincorporated Monroe County there are 161 repetitive loss properties (based on data as of October 2003). The cumulative payments (claims paid on building damage and on contents damage) range from just over $2,000 to more than $238,000. Figures 7-1 show the locations of the property addresses that were mappable (XX *insert number of addresses that* were not able to be mapped using the addresses provided). It is notable that [XX describe clusters?

[XX insert Figure 7-1 NFIP Repetitive Loss Properties (as of 10-2003). Requested 6/24 (may be six pages)

Coastal High Hazard Areas

Florida requires that local governments designate Coastal High Hazard Areas (CHHA) within their jurisdictions (FL Rule 9J5, F.A.C.). The CHHA must include areas designated on Flood Insurance Rate Maps as V Zones (areas subject to velocity hazard from wave action), areas that are seaward of the Coastal Construction Control Line (CCCL) established by the Florida Department of Natural Resources (DNR), and inlets which are not structurally controlled. The area subject to storm surge impact from a Category 1 Hurricane is considered to represent a good approximation of locations predicted to experience destruction or severe damage during storms and the Monroe County Comprehensive Plan, designates the CHHA as the "area subject to inundation by the SLOSH (model projections) associated with a Category 1 Hurricane."

Due to its low-lying terrain, approximately 80% of the County is located in the CHHA. Areas outside the CHHA are chiefly confined to a linear zone along much of U.S. 1 and some areas of higher elevation on various keys.

Coastal Barrier Resource System

The federal Coastal Barriers Resource Act (CBRA) of 1982 established the Coastal Barriers Resources System (CBRS). The purpose of the program is to restrict federally subsidized development of undeveloped coastal barriers to minimize loss of human life, reduce wasteful expenditures of federal funds, and reduce damage to fish and wildlife habitat and other valuable natural resources of coastal barriers. The intent of the CBRA is to remove from undeveloped coastal barriers federal incentives for new development, such as National Flood Insurance, structural stabilization projects, and Federal assistance for construction of sewers, water supply systems, airports, highways, and bridges.

As of 1992, the Coastal Barrier Resource System applied to 15 units in the Florida Keys; since then, some units have been expanded and some areas have been noted exempt. These sites are located throughout the county and include areas such as the undeveloped portion of North Key Largo and sections of Sugarloaf Key. Most of the CBRS units are largely undeveloped. Protection of these areas is provided through land use policies in the Comprehensive Plan and related land development regulations. Among the policies advocated for these sites is public acquisition, especially portions of North Key Largo.

7.4 Communicating about Hazards

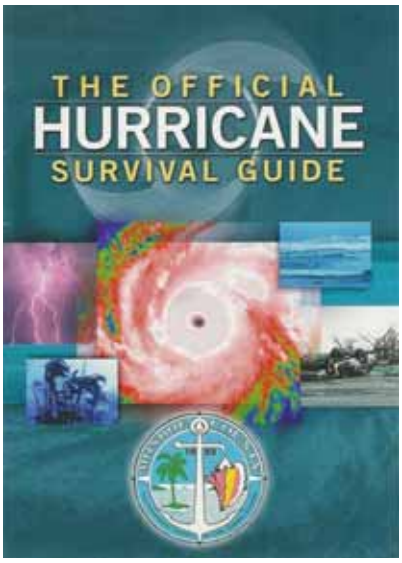
Monroe County and other organizations in the area recognize the importance of informing residents and visitors about hurricanes, evacuation, public safety, and minimizing damage. The following are some key ways that communications are undertaken:

- The front page of the Monroe County website has links for emergency management and emergency bulletins,
- The emergency management page offers information about hurricane preparedness, the Special Needs Registry, what to bring to shelters, and several links to pertinent sites,
- Emergency bulletins are posted when storm activity increases,

Coastal High Hazard Area

Areas which have historically experienced destruction or severe damage, or are scientifically predicated to experience destruction or severe damage from storm surge, waves, erosion, or other manifestations of rapidly moving or storm-driven water.

- People can request e-mail notification whenever emergency bulletins are issued or updated,
- Materials are provided in booths at local fairs,
- Presentations are offered to schools and other groups,
- Both electric companies provide information to property owners about tree trimming to reduce power outages,
- Public information and pre-recorded public service announcements are transmitted via local radio and television stations, including the County's cable channel,
- The Tourist Development Council is structured to transmit emergency information to the industry (e.g., blast FAX),
- The County's floodplain manager speaks before various professional organizations such as the Boards of Realtors and individual Real Estate companies,
- The County's web site includes several hazard-related pages, including one on floodplain management in the Keys (see graphic), and
- American Red Cross does some public service announcements.



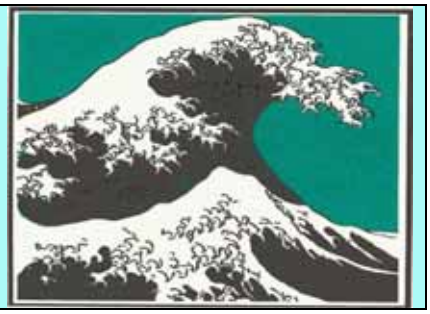
Hurricane wind and flood hazards are well-recognized throughout the Keys, but the importance of awareness is emphasized in the Floodplain Management Ordinance (at Section 9.5-317)(a)(13)) which states that:

"All agreements for deed, purchase, agreements, leases or other contracts for sale or exchange of lots within areas of special flood hazard shall carry the following flood hazard warning prominently displayed on the document: FLOOD HAZARD WARNING This property may be subject to flooding. You should contact the County Growth Management Division and obtain the latest information regarding flood elevations and restrictions on development before making use of this property".

Floodplain Management

The Florida Keys

http://www.monroecounty-fl.gov/Pages/MonroeCoFL_Growth/floodplain
(accessed June 2005)



FAQS	Forms and Applications
Flood Insurance	Flood Insurance Inspection Application
Flood Warning System	Inspection Transfer of Ownership Application
Floodplain management information	Non-County Certified Inspector List
What is the Flood Insurance Inspection Program?	AE Zone 4-12-04
How does the Flood Insurance Inspection Program Work?	VE zone 4-12-04
What is Habitable Space?	How to obtain demo permit
What is Limited Storage?	How to research a lower enclosure
What is the 50% Rule?	
Floodplain Management Ordinance	
FMA Technical Bulletins	
Monroe County Floodmaps on-line	

7.5 Recent and Near-Term Mitigation Actions

Improving resistance to the impacts of hurricanes is routine in Monroe County. Many action are not dependant on external funding but are part of the normal course of business and compliance with various regulations. As of mid-2005, the following characterize some of these activities:

- Public Works is developing a work order system which will automate issuance of instructions for periodic hurricane inspections of County buildings and facilities.
- The Key West Airport Authority is planning to replace a portion of the terminal, including a new tower. The facility must meet the wind resistance provisions of the Florida Building Code.
- Engineering is preparing to issue a solicitation for study of revetments that protect the shorelines of various County properties.
- A Public Works facility is being planned for Rickland Key. It will be designed as an "essential facility," which exceeds minimum design requirements for this type of building.
- Some County buildings have been retrofit under the State Shelter Retrofit Program.

Chapter 8: City of Key West

The City of Key West, the County seat of Monroe County, is located in the southernmost portion of the Lower Keys. Incorporated in 1832 and nicknamed the "Island City", the City is surrounded by the turquoise waters of the Gulf of Mexico and Atlantic Oceans. Aside from its natural beauty, Key West is noted for historic and cultural resources with over 2500 historic buildings and sites. The National Register Historic District is often referred to as "Old Town' and contains many unique wood frame structures that are over 100 years old.

8.1 Overview of Key West

Geography

The island of Key West comprises just 3,370 acres in area. It is low-lying, rising from 2 feet along the shoreline near Rest Beach to 16 feet above mean sea level at Solares Hill. Other higher elevations are man-made and are the waste management area (landfill) and bridges such as Garrison Bight Causeway. Most of the newer development, built on fill material, and are raised buildings. While most of the "Old Town" section averages around 7-feet MSL, certain locations important for tourism, such as Front Street, Key West Bight, and Mallory Square are only at 3-feet MSL. Critical areas such as Key West Airport and South Roosevelt Boulevard are at very low elevations (approximately 3-feet MSL).

The City's few natural beaches have oolitic limestone outcrops or thin sand and shell over a rocky base; a low dune exists at Rest Beach. Although sandy beaches are present along the southern shore (e.g., Higgs Beach and Smathers Beach), some were artificially constructed. Mangroves are present along small sections of the island's northern shoreline. Beaches on the southern shoreline experience erosion due to coastal currents, tides, and wave impact. The rate of erosion accelerates during storm events. Shallow waters surrounding the island may contribute to increased storm surge height. Canals, cuts, and inlets experience flooding due to storm surges that may be higher than along flat shorelines.

Population

Information provided by the Key West Planning Department indicates that the City of Key West has a permanent resident population of approximately 27,000 (including military personnel). The seasonal population increases by as much as 16,000. On any given day the number of people in town can increase dramatically due to the number of tourists that arrive on cruise ships.

Land Use & Economy

Key West essentially is completely developed, with a mix of single family residences, multi-family dwellings, time-share and seasonal units, tourist lodgings (hotels, motels, inns, bed and breakfasts, etc.), tourist-oriented uses (museums, attractions), marine-related and recreational uses, commercial uses (restaurants, retail sales, banks, Realtors), medical facilities and offices, and government uses. Redevelopment and renovation are constant activities.

Comprehensive Plan

Key West Comprehensive Plan includes such mitigation policies as restoration of the dune system using natural, indigenous vegetation for beach renourishment projects. The City applies performance criteria and regulatory techniques for hazard mitigation and loss reduction, such as prohibition in the Coastal High Hazard area of construction of sewage treatment plants, industrial holding ponds, and other point sources of pollution. Non-residential development must meet storm and floodproofing standards that exceed the minimums established by the National Flood Insurance Program.

The Coastal Management Element includes policies to restrict development in the Coastal High Hazard Area, including prohibition of construction of new sewage treatment plants, holding ponds, and other point sources of pollution. Non-residential development must meet storm and floodproofing standards that exceed minimums established by the National Flood Insurance Program.

8.2 City Organization and Agencies

The Key West City Commission is composed of 7 members, including the Mayor who is elected specifically to that office. The Commission sets government policy and adopts guidance documents, such as the Comprehensive Plan and ordinances establishing various codes and standards.

Key West is organized into several agencies, each with some authorized responsibilities that, as described below, have bearing on how natural hazards are recognized and addressed.

City Manager. The City Manager of Key West implements the policies of the Commission and administers the overall operations of the City. Related to mitigation of the impacts of natural hazards, the City Manager:

- Participates in post-disaster assessment and may develop mitigation initiatives to address reduction of future loss.

- Participates in the Key West Emergency Operations Center (EOC) and coordinates with the County and other local governments.
- Works with the City's Post-Disaster Recovery Task Force which serves as the City's designated Public Facilities Review Committee. This group is charged with the responsibility for reviewing available alternatives for damaged public facilities following a hurricane or other disaster.
- May perform an analysis and provide recommendations to the City Commission for hazard mitigation options, including relocation and reconstruction of damaged public facilities.
- Participates in intra- and inter-governmental disaster planning efforts, including multi-agency Site Plan Review Committee and Hazard Mitigation.

Key West Planning Department. The Key West Planning Department is responsible for the development and maintenance of the City's Comprehensive Plan. Department personnel serve as staff to the City's Planning Commission and, related to hazard mitigation:

- Ensures that mitigation related items in the Comprehensive Plan, such as floodplain management and natural resource management, are followed and reflected in the City's Codes and Standards.
- Participates in post-disaster appraisals and may formulate additional mitigation measures for use in the Comprehensive Plan.
- Works closely with building and zoning staff to ensure coordination of actions related to disaster planning, recovery, and mitigation.
- Incorporates mitigation recommendations, especially those based on direct disaster experience, in the Evaluation and Appraisal Reports (EAR) required for the Comprehensive Plan.

Key West Building and Zoning Department. The Building and Zoning Department recommends and implements policies provided in the City's Comprehensive Plan and Land Development Regulations. It also reviews construction plans, issues permits, and inspects projects for compliance. The Department is responsible for enforcing zoning and building standards. Department personnel serve as staff to the City's Historic Architectural Review Commission and:

- Supervise implementation of floodplain management controls and zoning regulations designed to minimize damage to structures from wind and waves resulting from storms.
- Enforce the Florida Building Code requirements for wind loads and anchoring foundations into bedrock.
- Implements zoning and development polices for the City's redevelopment areas (Bahama Village and Key West Bight), including mitigation measures

characterized in the Comprehensive Plan as follows "Within the Key West Bight Area, in order to curtail the likelihood of future property damage and/or exposure to the perils of storm driven tides, wind, and waves, the land development regulations shall include performance criteria which restrict building mass and building intensity at strategic locations vulnerable to storm surge".

- Participates in the Post-Disaster Recovery Task Force.

Key West, Florida

- *Building Department was established in 1916*
- *Code Enforcement Office has 6 inspections and administrative staff*
- *Building Department has 4 inspectors and support staff*

Table 8-1.

Permits Issued in 2003 & 2004

Type of Development	Calendar Year 2003	Calendar Year 2004
New single family	1,072	417
New other (commercial, industrial, religious, etc.)	66	66
New multi-family (2 or more)	14	20
Commercial (additions, renovation, conversions)	697	597
Residential (additions, renovation, conversions)	1,737	1,800
Other	2,983	2,686
Demolition	36	45
Relocation	0	0
Manufactured home (permanent, temporary)	7	12
Totals	6,612	5,643

Key West Historic Architectural Review Commission (HARC). Key West includes numerous historic resources, including a National Register Historic District. HARC reviews activities that impact historic structures and the historic district. The guidelines used by

HARC incorporate the principles of the Secretary of the Interior's Standards for Rehabilitation, along with local controls related to landscaping, signs, etc.

Because historic properties in Key West are treasures that require special treatment and contribute to the City's character which enhances tourism, it is important that the City consider policies that apply to reconstruction after damaging events. HARC developed a "Hurricane Preparation and Recovery Guide" specifically designed for the Key West National Register Historic District. It addresses application of flood height standards, codes, and use of materials that may be considered non-conforming, and requirements if the historic building would receive damage in excess of 50% of the value.

Key West Finance Department. The Finance Department is responsible for overseeing the day-to-day financial requirements of the City, including establishment of purchasing procedures for all agencies. To expedite preparation for, response to, and recovery from disasters, the Finance Department may implement special emergency procedures to expedite necessary purchase and payment before, during, and after a disaster.

Key West City Engineer. The Manager of the City Engineering Department is professionally qualified to review Civil Engineering plans to determine compliance with the Florida Building Code and construction requirements The Engineer performs other responsibilities relating to the construction and technical needs of the City, including overseeing the engineering requirements of public facilities such as roads, bridges, sewer treatment facility, and other City buildings.

After a damaging event, Engineering staff conduct damage assessments of public infrastructure and works with federal and state agencies such as FEMA and Florida DEM to develop scopes of work and to facilitate funding assistance for recovery operations. Under the federal Public Assistance Program, mitigation measures to reduce future loss to public facilities may be included in requests for recovery assistance. The City Engineer provides input to the Post-Disaster Recovery Task Force.

Key West Public Works Department. The Public Works Department is responsible for overseeing the maintenance and operation of all city facilities, including buildings, roads and bridges. IT operates and maintains the city's heavy equipment, vehicles, repair shop and fueling station.

Public Works is responsible for coordination and provision of emergency public works, evaluation of infrastructure damage, and preparation of documentation required for federal reimbursement (including identification of mitigation components to be incorporated during recovery), and coordination of emergency debris clearance.

In executing its disaster and recovery responsibilities, Public Works coordinates with the Florida Department of Transportation (FDOT), Monroe County Department of Public Works, Florida Keys Aqueduct Authority, and City Electric Incorporated. The Department plans, coordinates and initiates restoration of the serviceability of transportation routes, bridges, and assurance as to the safety and affected public and private dewllings and structures.

Key West owns approximately 100 buildings; many are leased to commercial concerns. Some buildings have hurricane shutters; the presence of rooftop equipment and whether it is anchored to resist hurricane winds is not known at this time. All work on buildings must comply with the Florida Building Code and other pertinent requirements (such as floodplain management). The City maintains flood insurance policies on some buildings. For leased buildings, generally if one is damaged the City provides some abatement of rent during the period of restoration. If one is destroyed, the lease would be terminated.

Key West Utilities Manager. The Utilities Manager is responsible for coordinating various utility resources in the city. These include the Richard A. Heyman Environmental Protection Facility, Sewage Treatment System and Plant, including pumping and lift stations, Garbage Collection Program, Southernmost Waste to Energy Facility, and City Electric Incorporated. These facilities have specific written emergency plans and procedures designed for use in emergencies such as tropical cyclones, severe storms, flooding and tornadoes. A separate plan for hazardous materials is specific to the Sewage Treatment Plant.

When reviewing the physical plant of the City's utility facilities, the Utilities Manager evaluates of vulnerability such as flood height, roof construction, and window protection. The Utilities Manager provides input in the Post-Disaster Recovery Task Force.

The Utilities Manager also directs the City's Transportation and Facilities Maintenance sections. The Facilities Maintenance section is responsible for maintenance and repairs on some government structures, and small new construction and additions.

Key West Transportation Department (PATA). The Transportation Department provides for citywide transportation services and operates a fleet of buses. It also assists in transportation and evacuation planning. The Department's Hurricane Plan and Procedures are designed to effectively implement its responsibility to move civilians to shelters or, in the event of an out-of-county evacuation, to staging areas for school bus transport to the mainland shelter at Florida International University. PATA participates in the emergency after-action process and formulates measures to address future needs.

Key West Police Department. The Police Department is responsible for overall law enforcement and protection of residents and visitors in the City of Key West. The Department plays a key role in planning and response during emergencies. The permanent standing Hurricane Preparedness Committee reports to the Chief of Police and is responsible for preparation, review, and revisions of plans, procedures, operations and training materials relating to hurricane preparation, response, and recovery. The committee prepares after-action critiques of every implementation or exercise of any element of the disaster response and recovery plan and provides recommendations for addressing future problems.

The Police Department's preparedness and response activities include supervision of the Emergency Law Enforcement and Traffic Control plan, coordination with other City Departments, and outside agencies (Monroe County Sheriff's Office and the Florida Highway Patrol to promote speedy and safe evacuation), communications with base operations, field personnel, and emergency shelters.

Key West Fire Department. The Fire Department provides emergency management assistance and direction to the City of Key West in concert with other duties of fire control, fire prevention, and fire and hurricane public education. The Department plays a lead role in planning and response for emergencies.

The Fire Department's preparedness and response mitigation activities include assisting Monroe County Emergency Management, directing the operations of the City's Emergency Operations Center, and contributing to pre-planning strategies and evacuation planning. The Department is responsible for planning for hazardous materials incidents, maintaining a hazardous materials inventory and response plan, and responding to hazardous materials incidents.

Key West Port Department. The City hosts many cruise ships through the year, serving approximately 1 million a year. The Ports Director meets with the U.S. Coast Guard when

impending weather conditions may prompt decisions regarding port operations and whether to close the Key West Harbor to cruise ships and other large vessels. Prior to storm conditions, the department coordinates preparation of private vessels in both the City Marina and Key West Bight Marina and secures the ports facilities.

8.3 Hazards and Risk in Key West

Historic Storms

From the wreck of the treasure-laden ship, Nuestra Senora de Atocha, destroyed by a hurricane in 1622 to the present, hurricanes have played a major role in the life of Key West. Some of the more significant events include:

- October 11, 1846. As one survivor commented, it was '"the most destructive of any that had ever visited these latitudes within the memory of man". Most of the damage was located in the north and west sides of the island, along Whitehead and Duval Streets to the Gulf (Bahama Village and Truman Annex) and the Key West Bight. Damage included buildings that were pulled off their foundations and swept out to sea, uprooted trees, destruction of a lighthouse, and the cemetery located along South Beach was washed away with the dead scattered in trees. Fort Zachary Taylor, which was under construction, was severely damaged.
- October 11 and 17, 1909. Listed by the National Hurricane Center as one of the most intense to affect the U.S., this storm was a Category 3 with a barometric pressure of 957 millibars. According to the Key West Historic Districts Hurricane Guide, "the arrival of this hurricane caught residents completely unprepared . . . Seven factories, several churches, and much of the waterfront was destroyed. Afterwards, debris clogged the streets." To make matters worse, another Category 3 hurricane struck on October 17, 1910, causing 30 deaths and $300,000 in damage (not adjusted).
- September 9-10, 1919. One of the most deadly and intense hurricanes listed in the records of the National Hurricane Center, this Category 4 storm (927 millibars), this storm caused approximately 600 deaths. Key West recorded winds of 95 mph and flood levels were 5-7 feet above Mean Sea Level.

Other Notable Hurricanes that Affected Key West

Hurricanes Donna (1960), Betsy (1965), and Inez (1966), Tropical Storm Alberto (1982), Hurricanes Kate (1982), Hurricane Floyd (1987), and Hurricane Andrew (1992).

- November 11-12, 1980. The most notable flooding not produced by storm surge resulted from the 24-hour event known as the "Veteran's Day Storm". Nearly 23 inches of rain – the area's record – resulted from the influence of Tropical Storm Jeanne over Cuba and a stalled cold front. Widespread flooding affected streets and low-lying areas that were unable to drain due to the flat topography and continual rainfall. Reports indicate that 300 vehicles and 500 buildings were seriously damaged.
- September 24-26, 1998. Hurricane Georges (Category 2) made landfall in the Lower Keys. The entire county was affected to some extent (1 death and $300 million total damage). Maximum sustained winds at the Naval Air Station (Boca Chica) were 92 mph and the Monroe EOC in Marathon reported gusts to 110 mph. According to the Key West Weather Service, precipitation levels in the Lower Keys were identified as 8.65 inches on the south side of Sugarloaf Key, 8.38 inches at Key West International Airport, and 8.20 inches on Cudjoe Key.
- October 22, 1999. With little warning, Hurricane Irene suddenly altered its course and crossed near Key West.

Damages due to Hurricane Georges

Table 8-2 summarizes reimbursements received by the City from FEMA's disaster assistance program (see also Table 5-7 for reimbursements received by others). These amounts underestimate the total cost of damage to public property and expenditures of manpower for recovery because they do not include the non-federal share nor do they include costs determined to be ineligible. Other than debris removal and emergency work on beaches, the two most costly projects were the seawall replacement ($6.9 million) and repairs at the incinerator plant ($535,000).

The damage left after Hurricane Georges moved through the Keys illustrates the vulnerability and the types and magnitudes of damage and costs. Among the reported damage were the following:

- The Hemingway House, a historic property, was damaged by a 146 year old Banyan tree weakened by the winds and rain.
- The Key West International Airport's runway was flooded and one private plane was overturned.
- A number of roads and sites were covered in sand and debris.
- Houseboats were damaged.
- Waterfront businesses suffered damage including lost piers and decks.

Table 8-2. FEMA Reimbursements for Hurricane Georges (DR#1249)

FEMA Category of Damage	Amount of Reimbursements
A Debris Removal	$3,390,800
B Emergency Protective Measures	$1,925,900
C Roads and Bridges	0
D Water Control Facilities	0
E Buildings and Equipment (Public)	$792,800
F Utilities	0
G Parks, Recreational Facilities and Other	$7,597,500
Totals	$13,707,000

Hurricane Flooding as Predicted by SLOSH Modeling

The National Hurricane Center's surge model, called SLOSH (Sea, Lake, and Overland Surges from Hurricanes), estimates surges associated with different characteristics of tropical cyclones (track, forward speed, wind speed, etc.). The results can be combined with topographic mapping to delineate inland areas subject to flooding (with a margin of error of +/- 20).

Table 8-3. SLOSH Maximum Predicted Water Depths above MSL

Ocean Side						Bay Side					
Track Direction	Storm Categories					Track Direction	Storm Categories				
	1	2	3	4	5		1	2	3	4	5
WSW	3	4	9	9	10	WSW	4	6	9	10	10
W	4	6	8	9	10	W	4	7	8	10	10
WNW	4	6	8	9	10	WNW	4	7	8	10	10
WN	4	6	7	9	9	NW	4	6	7	9	9
NNW	4	5	7	9	9	NNW	4	5	7	9	9
N	4	5	7	9	9	N	4	5	7	9	9
NNE	4	5	7	9	9	NNE	4	5	7	9	9
NE	4	5	6	8	9	NE	3	5	6	8	9
ENE	4	5	6	8	10	ENE	4	5	6	9	10
E	3	5	7	8	10	E	4	5	7	9	10

Rainfall/Fresh Water Flooding in Key West

In several locations the City's storm drain system is inadequate to handle as little as three to five inches of rainfall, which happens several times each year. The types of damage caused by flooding of this nature include traffic rerouting, business closures, and flooding above finished floor height and above of homes and businesses. In just the Old Town area at North Duval, a typical storm can disrupt businesses causing losses of approximately $10,000 each day. Damage to private structures and contents and the costs of clean up are not estimated. The most susceptible locations include:

NFIP Flood Insurance Policies in Key West: 8,345

Claims paid since 1978: 621

http://www.fema.gov/nfip/pcstat.shtm
(as of December 31, 2004)

- The north section of Old Town bounded by the Gulf of Mexico and Whitehead and Green Streets, some buildings experience flooding above finished floor elevation flooding approximately twice a year;
- Palm Avenue and Eaton Street (at White Street) which can reroute 5,000 vehicles per day during heavy rains, affects businesses, and causes stranding of residents of the adjacent housing authority homes;
- Sirugo Avenue and Sunshine Drive, which has floods above finished floors in residences annually;
- United Street and Thompson Street basin, which has causes flooding of residences finished floor;
- North Roosevelt Boulevard (US Highway 1) which floods two outbound lanes completely during heavy rain storms 2 to 3 times each year, negatively impacting businesses and causing significant traffic rerouting;
- Fourth Street at Patterson Avenue floods frequently, causing commercial business and residential traffic disruptions;
- Blanch, Dennis and Duncombe Streets causing school bus disruptions and flooding above finish floors of residences;
- Duck Street and 20th Street, causing traffic disruptions and flooding above finish floors of residences;
- Various very localized flooding spots causing water infiltration into homes and businesses can be found around town.

NFIP Floodplain Mapping

Key West has participated in the National Flood Insurance Program (NFIP) since September 1971. The City's current Flood Insurance Rate Map, prepared by FEMA, is dated February 15, 2002. The FIRM delineates areas that have been determined to be subject to flooding by

the "base flood," the flood that has a 1-percent-annual chance of flooding in any given year (commonly called the 100-year flood). Flooding of this frequency is not associated with a specific hurricane category. Key West has the following flood zones and flood elevations (above MSL) shown on the FIRM:

- VE Zones (coastal flood with velocity hazard wave action) of 11-13 feet are near the shoreline and in sections adjacent to Cow Key Channel on the border with Stock Island.
- AE Zones (areas subject to flooding but waves are predicted to be less than 3-feet in height) of mostly 7-9 feet are indicated for the newer sections of Key West and in areas of "Old Town" close to the shoreline.
- X Zones are delineated in most of the inland areas of the older, historic portion of the City. X Zones include areas determined subject to flooding by the 0.2-percent annual-chance flood (500-year) and areas that are outside the 500-year floodplain.
- AO Zones, where flood depths of 1-3 feet are predicted in sloping areas for Sunset Island offshore of the west side of Key West.

NFIP Repetitive Loss Properties

Data provided by the Florida Department of Community Affairs identifies properties that are, or have been, insured by the National Flood Insurance Program and that have received two or more claims of at least $1,000. Within unincorporated Key West there are 51 repetitive loss properties (see Figure 7-1; based on data as of October 2003). The cumulative payments (claims paid on building damage and on contents damage) range from just over $5,000 to more than $598,000.

Tornadoes in Key West

Table 8-4 includes information on tornadoes that have affected Key West since the late 1950s. Fortunately, no deaths or injuries have resulted.

Table 8-4. Tornadoes in Key West

Date	Fujita Scale	Damage (not adjusted)
July 1, 1959	F-0	$3,000
June 2, 1966	F-0	$25,000
June 18, 1972 (Hurricane Agnes)	F-2	$400,000
August 20, 1978	F-0	$25,000
June 28, 1979	F-0	$3,000
May 16, 1988	F-0	$1,000
May 3, 1989	F-0	Not reported
May 1999	F-0	Not reported

October 2000	F-0	Not reported
October 2003	F-0	Not reported

Source: NWS Key West Warning Meteorologist

Key West's Important and Critical Facilities

Figure 8-5 at the end of this chapter shows the locations of the City's bridges, water treatment and sewer facilities, city buildings and emergency facilities.

Table 8-5. Important and Critical Facilities in Key West

Critical/Essential Facilities: • 6 bridges • 17 sewer lift stations and one Wastewater Treatment Plant • 2 stormwater lift stations • City buildings (Old City Hall, City Hall with Fire Facilities, City Hall Annex, City Hall Parking Garage, Old Town Garage) Planning dept, . • City Parks & Recreational Facilities: Martin Luther King Pool Building, Indigenous Park, Mallory Square, Douglas Gym, Clayton Sterling sports complex, Wickers Sports Complex, Bayview Park Recreational Center, Fire Station Museum • Emergency Operations Center (Public Safety Facility), Fire Station #3, • Key West DOT Building, Public Works Building, OMI Repair Building • Southernmost Transfer Station	**Other Public Facilities:** • Dee Poo Hospital • Lower Florida Keys Health Center • U.S. Naval Hospital • Key West International Airport • Florida Highway Patrol Substation South Roosevelt Boulevard • US Coast Guard Base • Military Fuel Storage Facility • Keys Energy Services Main Office & Substation • Florida Keys Aqueduct (FKAA) Authority Main Office, Water Towers, Storage Facility, Pump Station
Hazardous Materials Sites (302 Facilities): • Bell South, 530 Southard Street • KES 1001 James Street • Key West Wastewater Treatment Plant, Trumbo Point Annex, Fleming Key • Naval Air Station, Trumbo Point	**Mobile Home and Recreational Vehicle Parks (as of October 1995):** • Key West Villas (Poinciana) LTD Mobile Home Park • Stadium Mobile Home Park • Key West Trailer Court • Mastic
Marinas: • A & B Marina • Galleon Marina • Garrison Bight Marina • Hilton Haven Marina • Key West Seaport • Key West Yacht Club Marina • Land's End Marina	**Cruise Ship and Ferry Ports:** • Mallory Square • Outer Mole • Pier B • KW Ferry Terminal

Table 8-5. Important and Critical Facilities in Key West

• Truman Annex Marina • City Marina • Ocean Key House

8.4 Damage Reduction Activities

On-Going Activities

The City activates a Post-Disaster Recovery Task Force after a major damaging event has occurred. In addition to members from City departments, various neighborhood and interest-based groups are represented. A main focus of the task force is to encourage public participation in the post-storm redevelopment planning and review process, including historic preservation interests. The Task Force also analyzes the outcome of an event and makes recommendations for mitigation.

Between 1992 and 1999 the City of Key West participated in the NFIP's Community Rating System. In mid-2005, the Key West Planning Department determined to seek reinstatement which, if approved, will yield a reduction in the cost of federal flood insurance.

Recent Projects

The City has undertaken various projects to reduce exposure to future damage, such as drainage improvements and retrofits of public buildings and facilities (with or without FEMA funding). Table 8-6 lists projects completed between 1999 and 2004.

Table 8-6. Key West Mitigation Projects (1999-2004)

	Mitigation Project Location
Storm Shutters	Key West Transfer/SWTE
	DOT Building
	FDS Gym
	Fire Station #1 HMGP
Stormwater Improvements	Grinnel Street (Backflow preventers)
	William Street
	Elizabeth Street
	Green Street
	Duval Street
	Ashby Street Pump Station
	Simonton Street (Duval/Front Pump Station)

Table 8-6. Key West Mitigation Projects (1999-2004)

	Mitigation Project Location
	Major Pipe Cleaning Project
Injection Well Projects	White Street
	Kamien Subdivision
	Fort Street
	Reynold Street
	Searstown/Donald Ave
	2005 Project: 26 Locations
	Margaret Street
	Olivia Street
Berms & Beaches	Rest Beach Berm
	Dog Beach Berm
	South Beach Berm
	Simonton Beach Berm
	Smathers Beach Berm
	Seawall Additional Length
	South Beach Pier

CRITICAL FACILITIES MAP

HURRICANE PREPAREDNESS
LONG RANGE MITIGATION STRATEGY PLAN

BRIDGES

1. FLEMING KEY
2. GARRISON BIGHT
3. SALT RUN CHANNEL
4. 9TH STREET CANAL
5. RIVIERA CANAL
6. COW KEY CHANNEL

SLS - SEWER LIFT STATIONS

- (A) 250 AMELIA ST.
- (B) 613 GREENE ST.
- (C) 699 PALM AVE.
- (D) 1329 SEMINARY ST.
- (DA) 1391 ATLANTIC BLVD.
- (E) 2430 GOVERNMENT RD.
- (F) 1460 FOURTEENTH ST.
- (G) 3545 FLAGLER AVE.
- (H) 250 TRUMBO RD.
- (I) 3105 N. ROOSEVELT BLVD.
- (J) 3906 S. ROOSEVELT BLVD.
- (K) 3485 S. ROOSEVELT BLVD.
- (L) 3657 S. ROOSEVELT BLVD.
- (M) 3805 S. ROOSEVELT BLVD.
- (N) 2401 S. ROOSEVELT BLVD.
- (O) 2700 VENETIAN DR.
- (P) GARRISON BIGHT CAUSEWAY
- (Q) WASTEWATER TREATMENT PLANT

CITY FACILITIES

- [1] OLD CITY HALL
- [2] CITY HALL
- [3] M.L. KING POOL BLDG.
- [4] INDIGENOUS PARK
- [5] MALLORY SQUARE
- [6] DOUGLAS GYM
- [7] WICKER'S SPORTS COMPLEX
- [8] BAYVIEW PARK REC. CENTER
- [9] PUBLIC SAFETY FACILITY
- [10] FIRE STATION #1
- [11] FIRE STATION #3
- [12] KW/DOT BLDG.
- [13] PUBLIC WORKS
- [14] OMI REPAIR BLDG.
- [15] FIRE STATION MUSEUM
- [16] CITY HALL ANNEX
- [17] CITY HALL PARKING GARAGE
- [18] OLD TOWN GARAGE
- [19] SOTHERNMOST WASTE TO ENERGY FACILITY

EMERGENCY FACILITIES

- [1] EMERGENCY OPERATIONS CENTER
- [2] DEPOO HOSPITAL
- [3] LOWER FLORIDA KEYS HOSPITAL

City of Key West
Engineering Services
604 Simonton Street
Key West, Florida 33040
(305) 292-8195

B-270 aug. 11, 1999 dis

Chapter 9: City of Layton

The City of Layton, incorporated in 1963, is located in the Middle Keys primarily on the east side of Overseas Highway, just north of Long Key State Park entrance.

9.1 Overview of Layton

Geography

Layton comprises just 85 acres in area. Layton is building almost entirely on waterfront property, mostly canals. It is low-lying, with all land below about 6 feet above mean sea (MSL).

Population

Layton has a permanent resident population of 192. The seasonal population increases to as much as 250. Current population projects indicate the permanent population may grow to 205 by 2010.

In 2004, the Monroe County Social Services registered just one person people in the Layton area as having special needs for hurricane assistance.

Land Use & Economy

Layton's development is primarily single family residences located along canals and small businesses (restaurants and convenience stores).

Future growth is limited through the Rate of Growth Ordinance to implement portions of the City's Comprehensive Plan. ROGO, as the ordinance is called, establishes a building permit allocation system for residential construction. The purpose is to encourage in-fill of platted lots served by existing infrastructure and to limit growth to enable safe and timely hurricane evacuation. Pursuant to ROGO and an agreement between the City, County and the department of Community Affairs, the annual allocation for Layton is three permits per year for residential dwelling units.

All new construction, reconstruction, and improvements to existing buildings must comply with the current building code requirements.

Layton joined the National Flood Insurance Program in July 1971 and administers a floodplain management ordinance that meets or exceed the minimum federal requirements.

9.2 City Organization and Agencies

Layton's City Council is composed of 6members, including the Mayor who is elected specifically to that office. The City Council sets government policy and adopts guidance documents, such as the Comprehensive Plan (1996) and ordinances establishing various codes and standards.

Layton is organized into several agencies, each with authorized responsibilities that, as described below, have bearing on how natural hazards are recognized and addressed.

Mayor. The Mayor implements the policies of the Commission and administers the overall operations of the City. In fulfilling these duties, the City Manager:

Layton Planning Department. The Planning Department is responsible for the development and maintenance of the City's Comprehensive Plan.

City Building Official. The Building Official reviews construction plans, issues permits, and inspects projects for compliance. Layton has adopted the Florida State Building Code. The Department is responsible for enforcing zoning and building standards and the Land Development Regulations.

Layton , Florida

- *Building Department has 1 staff member*
- *Planning Department has 1 staff member*
- *Code Enforcement Department has 1 staff member and an appointed Code Enforcement Board*

Table 9-1. Layton: Permits Issued (2003, 2004).

	Calendar Year 2003	Calendar Year 2004
New single-family, detached	0	8
New single-family, attached	0	0
Multi-family (2 or more)	0	0
Non-residential (all types)	0	0
Residential (additions, alterations, repairs)	19	23

Table 9-1. Layton: Permits Issued (2003, 2004).

	Calendar Year 2003	Calendar Year 2004
Non-residential (additions, alterations, repairs)	0	0
Demolition	0	0
Relocation	0	0
Mobile home (permanent/temporary)	0	0
Total Permits Issued	19	31

9.3 Hazards and Risk in Layton

Historic Storms

Hurricane Donna (August 29-September 19, 1960). A Category 4 hurricane, this storm is listed among the most intense in U.S. history. It curved northwestward over the Middle Keys before turning north towards the mainland at Naples and Fort Myers. Wind speeds of 128 mph and central pressure of 28.44 inches were measures. Tide levels ranged from 13.5 feet above MSL at Upper Matecumbe Key, +10 feet at Plantation Key, and 8.9 feet in Key Largo. The high water mark closest to Layton was nearly 8 feet (ocean side, Craig Key Mile Marker 72).

Hurricane Betsy (August 26-September 12, 1965). A Category 3 hurricane, Betsy passed over Marathon moving westward into the Gulf of Mexico. At Tavernier, central pressure was recorded at 18.12 inches and wind speeds were estimated at 120 mph. Flood levels were measures at 9 feet MSL in Key Largo.

Ground Hog's Day Storm (February 2, 1998). This severe weather system produced tornadic activity in the area.

Hurricane Georges (September 25, 1998). Near Layton at Mile-Marker 70, storm debris rendered U.S. 1 impassable to civilian vehicles. The high water marks closest to Layton were 4.6 feet at Mile-Marker 69.5 and 5.7 feet at Long Key State Park Mile-Marker 66.8.

Tropical Storm Mitch (November 4-5, 1998) affected the City of Layton.

Effect of Recent Hurricane Disasters

Damage from Hurricane Georges is representative of Layton's exposure:

- Damaged city property; a reimbursement of over $7,000 was received for damage to signs and streets, park cleanup, and EOC staffing.
- All private residences that were below the crown of the city's streets received flooding, and most roofs suffered wind damage (shingles). About 2% of homes sustained significant wind damage.
- Due to a 4-day power outage, all businesses were closed or experienced restricted operations.
- Lobster fishermen lost approximately 50% of their traps.

Hurricane Flooding as Predicted by SLOSH Modeling

The National Hurricane Center's surge model, called SLOSH (Sea, Lake, and Overland Surges from Hurricanes), estimates surges associated with different characteristics of tropical cyclones (track, forward speed, wind speed, etc.). The results can be combined with topographic mapping to delineate inland areas subject to flooding (with a margin of error of +/- 20%). The closest available predications are made for Conch Key Mile-Marker 63 and Islamorada Mile-Marker 82 (Table 9-2). Although storm surge flooding cannot be predicted simply at any given location, these charts can be used to approximate surge flooding in Layton.

Table 9-2. SLOSH Maximum Predicted Water Depths above MSL

Ocean Side Mile-Marker 63						Ocean Side Mile Marker 82					
Track Direction	Storm Categories					Track Direction	Storm Categories				
	1	2	3	4	5		1	2	3	4	5
WSW	4	6	8	9	9	WSW	4	5	7	8	9
W	4	6	7	8	9	W	4	6	7	9	10
WNW	4	5	7	8	9	WNW	4	6	7	9	10
WN	4	5	7	7	8	NW	4	6	7	9	10
NNW	4	5	6	7	8	NNW	4	5	7	8	10
N	3	5	6	7	8	N	4	5	7	8	9
NNE	3	4	6	7	8	NNE	4	5	6	8	9
NE	3	5	6	8	9	NE	4	5	6	7	8
ENE	4	6	8	10	11	ENE	3	5	6	7	8
E	5	8	10	11	12	E	3	4	6	7	8

NFIP Floodplain Mapping

Layton has participated in the National Flood Insurance Program (NFIP) since July 1971. The City's current effective Flood Insurance Rate Map, prepared by FEMA, is dated February 19, 2005. The FIRM delineates areas that have been determined to be subject to

flooding by the "base flood," the flood that has a 1-percent-annual chance of flooding in any given year (commonly called the 100-year flood).

All land in Layton is subject to flooding; all buildings are subject to some degree of risk depending on type of construction and elevation above grade. Areas designated as VE Zones (coastal flood with velocity hazard wave action) are shown as exposed to flooding ranging from 11-13 feet above MSL. Areas delineated as AE Zones (areas subject to flooding but waves are predicted to be less than 3-feet in height) are exposed to flooding 8-9 feet above MSL.

NFIP Flood Insurance Policies in Layton: 99

Claims paid since 1978: 4

http://www.fema.gov/nfip/pcstat.shtm
(as of December 31, 2004)

NFIP Repetitive Loss Properties

Data provided by the Florida Department of Community Affairs identifies properties that are or have been insured by the National Flood Insurance Program and that have received two or more claims of at least $1,000. Based on data as of October 2003 there are no repetitive loss properties in Layton.

Severe Storms, Tornadoes, Water Spouts and High Winds (Other than Hurricane)

Layton, like the rest of the Keys, has low-lying terrain. Section 6.2 characterizes the entire area encompassed by Monroe County and the cities as having equal distribution of winds. The risk of severe storms, tornadoes, water spouts and high winds in Layton does not vary from the rest of the planning area. All new buildings, replacement buildings, and additions to existing buildings must comply with the Florida Building Code's wind load requirements.

Rainfall/Ponding Flooding

Layton does not have any identified areas where rainfall/ponding flooding is so severe or prolonged as to cause access problems or damage to buildings.

Drought Hazards

Drought hazards for the planning area are described in Section 6.6. Layton's risk due to drought is comparable the drought risk throughout the area.

Wildland Fire Hazards

The Florida Forestry Department has not indicated that areas in Layton are likely to experience significant risk of wildland or brush fires. The exception to this statement may

be along the city's boundary with Long Key State Park where natural vegetation may increase fire hazards during some dry periods.

Risk: Layton's Critical and Important Facilities

Table 9-2. Important and Critical Facilities in Layton

Critical/Essential Facilities: • City Hall/Fire Rescue Complex • Bell South Mobility Towner • Florida Keys Aqueduct Authority Pumping Station (Mile-Marker 70, Long Key)	**Other Facilities:** • Florida Keys Marine Laboratory • U.S. Post Office
Hazardous Materials Sites (302 Facilities): • None	**Mobile Home and Recreational Vehicle Parks (as of October 1995):** • None
Marinas: • KT's Marina	

9.4 Damage Reduction Activities

On-Going Activities

- The City's Comprehensive Plan policies include provisions for limiting densities in the Coastal High Hazard Area, improving hurricane evacuation timing, and protection of native vegetation and natural shorelines.
- Other measures dealing with hazard planning include the consideration of mobile home restrictions and the need to increase the availability of emergency generators for use in the City.
- The Building Department implements mitigation policies reflected in the Building Code and Land Development Regulations, including standards to reduce vulnerability to high wind load and enforcement of the "substantial improvements" rule.
- The Planning Department implements mitigation measures reflected in the Comprehensive Plan and Land Development Regulations, including regulations designed to minimize damage to structures from wind and waves resulting from storms and floodplain management controls.
- New construction must include storm shutters designed to resist design winds of 159 mph and debris impacts.
- The Comprehensive Plan calls for engineering and other analyses to be undertaken before post-disaster redevelopment is undertaken so that appropriate building regulations can be adopted and design guidelines established for replacement or repair of infrastructure.

Layton participates in the Community Rating System (CRS) of the National Flood Insurance Program. The CRS recognizes actions that exceed the minimum requirements. In return, the City's property owners enjoy a 10% reduction in the cost of NFIP flood insurance. Actions undertaken by the City include:

- Maintains elevation certificates
- Makes NFIP map determinations
- Sends annual NFIP mailings to all local lenders, realtors, and insurance companies
- Keeps NFIP library in City Hall
- Warns citizens of impending flooding

Recent Projects

In 2002, with a Federal-State Hazard Mitigation Grant, the City of Layton installed hurricane retrofit measures to the City Hall/Fire Station to meet the 159 miles per hour standards. The total cost was $75,000 (50% Federal, 25% State, 25% City).

Chapter 10: City of Key Colony Beach

10.1 Overview of Key Colony Beach

Geography

Key Colony Beach, a man-made island community built in 1957, comprises just 285 acres in area. It is low-lying, with all land below about 5.5 feet above mean sea (MSL). The entire south shore faces the Atlantic Ocean and the west shoreline faces Vaca Cut, which connects the Atlantic to the Gulf of Mexico. The island, located approximately between Mile Marker 53 and Mile Marker 54, contains numerous dead-end canals, channels and bays that experience flooding due to storm surges that may be higher than along flat shorelines.

Population

Key Colony Beach has a permanent resident population of 836. The seasonal population increases by as much as 3,600. Current population projects indicate the permanent population may grow to about 950 by 2010.

In 2004, the Monroe County Social Services registered 12 people in the area between Mile Marker 53 and Mile-Marker 60 as having special needs for hurricane assistance.

Land Use & Economy

Key Colony Beach is a well-planned community comprised of single family, duplex, and multifamily dwellings. These uses are served by limited commercial development, including light retail, restaurants, offices and marinas. Just over 10% of the land area is used for recreational purposes.

The City joined the National Flood Insurance Program in July 1971 and administers a floodplain management ordinance that meets or exceeds the minimum federal requirements. About 40% of the buildings were constructed prior to 1971.

Comprehensive Plan

The City of Key Colony Beach adopted its Comprehensive Plan in February 1992. The plan includes nine elements pertaining to the future growth and development of the City. Throughout the plan are numerous goals, objectives and policies that acknowledge hurricane risks, especially related to evacuation, growth, ensuring safety, providing adequate facilities, managing storm water, working with providers of water supply and wastewater services, and requirement compliance with codes. The Infrastructure Element and the Conservation and Coastal Element contain specific policies relevant to mitigation of future risk and damage.

The Infrastructure Element includes:

- Complete a detailed engineering study of drainage and implement priority storm water projects. As of mid-2005 date, the City is 50% construction complete with citywide storm water retention systems.
- On-site wastewater disposal facilities to minimize potential environmental impacts. The City's wastewater treatment plant was installed in 1970 and has been upgraded to 2010 standards.
- Establish and coordinate acquisition programs. The City has acquired several properties over the past five years.

The Conservation and Coastal Element includes:

- New development encroaching into the 100-year floodplain shall incorporate elevation and flood protection measures sufficient to protect against the 100-year flood.
- The City shall maintain consistency with program policies of the National Flood Insurance Program.
- The City shall monitor new, cost-effective programs for minimizing flood damage.
- Such programs may include modifications to construction setback requirements or other site design techniques, as well as upgraded building and construction techniques.

10.2 City Organization and Agencies

The City of Key Colony Beach is a Commission Form of Government. The City Commission is composed of 5 members, including the Mayor who is selected by the Commission to that office. The City Commission sets government policy and adopts guidance documents, such as the Comprehensive Plan, the Land Development Regulation, and ordinances establishing various codes and standards.

Key Colony Beach is organized into several departments, each with authorized responsibilities that, as described below, have bearing on how natural hazards are recognized and addressed.

Mayor/City Administrator. The Mayor of Key Colony Beach implements the policies of the Commission and administers the overall operations of the City. With regard to floodplain management the Mayor (or designee) is appointed to administer and implement these provisions consistent with the requirements of the National Flood Insurance Program.

Key Colony Beach Planning and Zoning Committee. The Key Colony Beach Planning and Zoning Committee is responsible for the development and maintenance of the City's Comprehensive Plan and the Land Development Regulations. City personnel serve as staff to the and are involved in the following related to hazard mitigation:

- Ensures that mitigation related items in the Comprehensive Plan, such as floodplain management and natural resource management, are followed and reflected in the City's Codes and Standards.
- Participates in post-disaster appraisals and may formulate additional mitigation measures for use in the Comprehensive Plan.
- Works closely with the Building, Code Enforcement, and Fire Department to ensure coordination of actions related to disaster planning, recovery, and mitigation.
- Reviews construction plans for compliance to the NFIP regulations.
- Responsible for enforcing planning and zoning standards.

Key Colony Beach Building Department. The Building Department is responsible for regulations of building construction pertaining to life safety, health, and environmental land use zoning regulations. The department is staffed by the Building Official, a Building Inspector, a Permit Clerk and an on-call State of Florida Registered Engineer. Related to mitigation of hazards, the department is responsible for the following:

- Review of construction plans and issuing building permits
- Inspection and enforcement during construction
- Designated as coordinator for the National Flood Insurance Program.
- Assist the public in identifying and implementing flood damage prevention measures.
- Participate in post-disaster appraisals.
- Work closely with the Planning, Fire, and Code Compliance Department to ensure coordination of actions related to disaster planning, recovery, and mitigation.

Table 10-1. Permit Statistics for 2004.

Permits Issued	CY 2004
New single-family, detached	3
Duplexes	4
Multi-family (3 or more)	1
Non-residential (all types)	0
Residential (additions, alterations, repairs)	304

Table 10-1. Permit Statistics for 2004.

Permits Issued	CY 2004
Non-residential (additions, alterations, repairs)	3
Demolition	2
Relocation	0
Number of inspections	901

Key Colony Beach Public Works Department. The Public Works Department works under the Building Official and is responsible for overseeing the maintenance of most city facilities, including buildings, roads, and bridges. It operates and maintains City vehicles.

Public Works is responsible for coordination and provision of emergency public works, initial evaluation of infrastructure damage and preparation of documentation required for federal reimbursement (including identification of mitigation components to be incorporated), and coordination of emergency debris clearing.

In executing its disaster recovery responsibilities, Public Works coordinates with the Florida Department of Transportation, Monroe County Department of Public Works, Florida Keys Aqueduct Authority, and Florida Keys Electric Co-op. The department plans, coordinates and initiates restoration of the serviceability of transportation routes, bridges, and assurance as to the safety of affected public and private dwellings and structures.

Key Colony Beach Code Enforcement Board and Officer. The Code Enforcement Board and Officer oversee after-the-fact code compliance issues pertaining to safety, health, and environmental land use zoning regulations. The department is staffed by a Code Enforcement Officer and an Administrative Assistant. Related to mitigation of hazards, the department is responsible for: working closely with the Building, Planning, and Fire departments to ensure coordination of actions related to disaster planning, recovery, and mitigation; and participating in post-disaster appraisals.

City Clerk/Finance Administrator. The Finance Administrator is responsible for overseeing the day-to-day financial requirements of the City, including establishment of purchasing procedures for all agencies. To expedite preparation for, response to, and recovery from disasters, the Finance Administrator may implement special emergency procedures to expedite necessary purchase and payment before, during, and after a disaster.

Key Colony Beach Police Department. The Key Colony Beach Police Department is responsible for overall law enforcement and protection of residents and visitors in the City of Key Colony Beach. The department plays a key role in planning and response during emergencies to include but not limited to: coordination with Florida Highway Patrol to promote speedy and safe evacuation, communicates with base operations, field personnel, and emergency shelters.

Marathon Fire Department. The City contracts with the Monroe Fire Department to provide emergency management assistance and direction to the City of Key Colony Beach for all life safety in connection with other duties of fire control, fire prevention, and fire and hurricane public education. The department plays a lead role in planning and response for all emergencies. As required under U.S. Homeland Security Presidential Directive 5, has adopted and uses the National Interagency Incident Management System (NIIMS) and will adopt the National Fire Service Incident Management System (IMS) Incident Command System (ICS) as the baseline incident management system. ICS is implemented for all fires, haz-mat incidents, rescues, structural collapse and urban search and rescue operations, manmade and natural disasters, and EMS responses that require two or more rescue companies.

10.3 Hazards and Risk in Key Colony Beach

Historic Storms that have affected the Key Colony Beach Area:

- 1929 Hurricane (September 22 to October 4) – The hurricane crossed over Key Largo on a northerly course. Key Largo reported winds estimated at over 100 mph, a central barometric pressure of 28 inches, and tide levels of 8-9 feet above MSL. Key West experienced tide levels of 5-6 feet above MSL and winds of 66 mph.
- 1935, Hurricane (August 29-September 10) - The small, extremely violent, Category 5 hurricane crossed the Florida Keys on a northwesterly track. The Tavernier-Islamorada area reported winds estimated at 120 mph with gusts from 190-210 mph. Tide levels in the Florida Keys ranged from 14 feet above MSL in Key Largo to 18 feet above MSL in Lower Matecumbe Key. The storm was so intense and tightly wrapped that Key West had tide levels of only 2 feet above MSL and average sustained winds of less than 40 mph. One of the most tragic aspects of the 1935 storm was the unfortunate death of many WWI veterans who were working on construction of Henry Flagler's Overseas Railroad.
- Hurricane Donna, 1960 (August 29-September 19) – Hurricane Donna curved northwestward over the Middle Keys near Long Key/Layton and then traveled northward toward the Gulf Coast towns of Naples and Fort Myers. Areas in the

vicinity of the storm experienced winds speed of 128 mph and a central pressure of 28.44 inches. The storm affected the Everglades with estimated winds of 150 mph. Tide levels were reported at Upper Matecumbe Key of 13.5 feet above MSL, at Plantation Key 10+ feet above MSL, and 8.9 feet above MSL in Key Largo. As of 1992 Hurricane Donna, a Category 4 storm is listed as the 6th most intense hurricane in the US.

- Hurricane Betsy, 1965 (August 26-Septmber 12) – Hurricane Betsy passed over Marathon while moving westward into the Gulf of Mexico. The lowest central pressure was measured in Tavernier at 28.12 inches and wind speeds were estimated to be 120 mph. Tide levels in Tavernier were 7.7 feet above MSL and Key Largo had tide levels of around 9 feet above MSL. Betsy was a Category 3 storm and is ranked 25th in intensity.
- Ground Hog's Day Storm (February 2, 1998) involved multiple F-2 tornado touchdowns resulting from severe thunderstorms characterized by dangerous cells with high, cold cloud tops affected the Florida Keys. Areas most affected were primarily in the Middle Keys including Grassy Key and Valhalla Beach in the vicinity of Duck Key. Several buildings were damaged. Also significant problems occurred from the displacement of lobster traps that contributed to seaborne debris and navigational problems; the fishing industry suffered considerable loss of income.
- Severe thunderstorms (July 4, 1998). Severe thunderstorms with lightning and high winds came up quickly in the Middle Keys. The Weather Service Office in Key West recorded wind speeds up to 70 mph sustained. Because it was July 4th, many boats were offshore celebrating and waiting for the fireworks. Although, this event did not warrant a presidential disaster declaration, it did result in loss of life.
- Hurricane Georges, 1998 (September 25, 1998), a Category 2 when made landfall in the Lower Keys, affecting the entire county to some extent. Damage estimates approached $300 million, including insured and uninsured damage and infrastructure loss. Maximum sustained winds at the Naval Air Station (Boca Chica) near Key West were 92 mph; gusts up to 110 mph were reported by the Emergency Operations Center in Marathon. According to the Key West Weather Service, precipitation levels in the Lower Keys were as 8.65 inches on the south side of Sugarloaf Key, 8.38 inches at Key West International Airport, and 8.20 inches on Cudjoe Key. Tavernier in the Upper Keys recorded 8.41 inches. In Key Colony Beach storm surge flooding exceeded six feet over normal high tide. All city streets and many buildings were flooded, with approximately 125 damaged ground level dwelling units.
- Tropical Storm Mitch, 1998 (November 4 and 5). Feeder bands from Mitch containing dangerous super cells spawned several damaging tornadoes in the Upper Keys. Sections with mobile homes were especially hard hit. Islamorada experienced an F-1 tornado; Rock Harbor and Key Largo were hit by F-2 tornadoes. According to the Department of Community Affairs, damages were estimated at $11 million.

- Hurricane Irene, October 1999. Hurricane Irene hit the Florida Keys and Southeastern Florida. This Category 1 Hurricane dumped 10 to 20 inches of rain resulting in severe flooding in the Florida Keys and Southeastern Florida causing total damage estimated at $800 million
- Tropical Storm Gabrielle, September 2001. Although it did not reach hurricane strength, this storm hit the southwest coast of Florida and caused flooding problems; Marathon did see some effects from the storm.

Some Costs of Recent Hurricane Disasters

Damage from Hurricane Georges is representative of Key Colony Beach's exposure to tropical cyclones:

- Debris removal costs exceeded $300,000
- Repair of city street signage and parks cost $7,900
- Waterway cleanup, including buoy replacement, cost $8,300
- Manning the EOC, search and rescue, and emergency labor and supplies cost $8,600
- Contract for structural engineering support was $16,300
- Repairs to the wastewater treatment system cost $31,400
- Repairs to the storm water system cost $36,000

Damage sustained on private property included:

- Wind and flood damage was estimated at $4.4 million
- Approximately 10% of all residences were damaged, notably those that predated the City's floodplain management requirements
- Approximately 5% of fiberglass roof singles and concrete tile roofs were damaged
- 4% of all structures sustained significant flood, wave and wind damage
- All businesses were closed or severely restricted due to structural damage and power outages
- Tourist-based businesses were most affected

Hurricane Flooding as Predicted by SLOSH Modeling

The National Hurricane Center's surge model, called SLOSH (Sea, Lake, and Overland Surges from Hurricanes), estimates surges associated with different characteristics of tropical cyclones (track, forward speed, wind speed, etc.). The results can be combined with topographic mapping to delineate inland areas subject to flooding (with a margin of error of +/- 20%). The closest available predications are made for Marathon Mile-Marker 50 and

Duck Key Mile-Marker 61 (Table 10-2). Although storm surge flooding cannot be predicted simply at any given location, these charts can be used to approximate surge flooding in Key Colony Beach.

Table 10-2. SLOSH Maximum Predicted Water Depths above MSL

Ocean Side Mile-Marker 50						Ocean Side Mile Marker 61					
Track Direction	Storm Categories					Track Direction	Storm Categories				
	1	2	3	4	5		1	2	3	4	5
WSW	4	5	6	7	8	WSW	4	5	6	7	8
W	4	5	7	8	9	W	4	5	7	8	9
WNW	4	6	7	8	9	WNW	4	6	7	9	10
WN	4	6	7	8	9	NW	4	5	7	8	10
NNW	4	5	7	8	9	NNW	4	5	7	8	9
N	4	5	7	8	9	N	4	5	6	8	9
NNE	4	5	6	7	9	NNE	4	5	6	8	9
NE	4	5	6	7	8	NE	4	5	6	7	9
ENE	3	5	6	7	8	ENE	3	5	6	7	8
E	3	4	5	6	7	E	3	4	5	6	8

NFIP Floodplain Mapping

The National Flood Insurance Program (NFIP) prepared a Flood Insurance Rate Map for Monroe County (current effective map is dated February 18, 2005). The FIRM delineates areas that have been determined to be subject to flooding by the "base flood," the flood that has a 1-percent-annual chance of flooding in any given year (commonly called the 100-year flood).

The entire City is located in areas designated as VE Zones (coastal flood with velocity hazard wave action) and AE Zones. With land elevations averaging 4-7 feet, water depths associated with the 1%-annual chance flood can be expected to range from 4 to 9 feet. As indicated by the predicted storm surge flood depths, even deeper flooding will occur during more severe hurricanes. As such, all new development in the City is subject to the floodplain management standards established in the City's Land Development Regulations.

NFIP Flood Insurance Policies in Key Colony Beach: 1,213

Claims paid since 1978: 128

http://www.fema.gov/nfip/pcstat.shtm
(as of December 31, 2004)

NFIP Repetitive Loss Properties

Data provided by the Florida Department of Community Affairs identifies properties that are or have been insured by the National Flood Insurance Program and that have received two or more claims of at least $1,000. Within unincorporated Key Colony Beach there are 9 repetitive loss properties (see Figure 7-1; based on data as of October 2003). The cumulative payments (claims paid on building damage and on contents damage) range from just over $7,000 to more than $348,000.

Stormwater Management & Rainfall/Ponding Flooding

Key Colony Beach's Stormwater Management Master Plan, prepared in 1995, identifies areas of localized flooding and specific engineered construction plans to minimize local flooding that includes closed drainage systems, open swales, retention ponds, covered trenches, and injection wells. This project is approximately 50% completed construction as of this date.

Wildland Fire Hazards

The Florida Forestry Department indicates that in the Key Colony Beach area, Grassy Key (including Geiger and Boca Chica) is the area most prone to wildland/brush fires. Based on data provided by Monroe County Property Appraiser, Grassy Key includes a total of 9,391 parcels of land of which 6,498 are improved. The total assessed value of improvements is $1,562,786,704. It is important to note that this summary is not to imply that all properties would be vulnerable in any given wildfire outbreak. Future development on Grassy Key is influenced by property owner choices; all new construction must comply with environmental restrictions.

Key Colony Beach's Important and Critical Facilities

Figure 10-1 shows the locations of the City's water treatment and sewer facilities, city buildings and emergency facilities that are listed in Table 10-2.

Table 10-3. Important and Critical Facilities in Key Colony Beach

Critical/Essential Facilities:	**Other Public Facilities :**
• City Hall-Police/Auditorium/Post Office Complex • Wastewater Treatment Plant and System • Stormwater System • Public Works Building	• Public Golf Courses • Public Tennis Courts • City Parks and Playground
Hazardous Materials Sites (302 Facilities):	**Marinas:**
• Wastewater Treatment Plant (chlorine and	• The Boat House (MM 53.5, Ocean side)

Table 10-3. Important and Critical Facilities in Key Colony Beach

sulfuric acid)	• Key Colony Beach Marina (MM53.7, Ocean side)

10.4 Damage Reduction Activities

On-Going Activities

- Comprehensive Plan objectives and policies address the need to hold down densities so as not to increase hurricane evacuation times. A stated objective of the Plan is to: "Grant no land use amendments that would increase the land use density and intensity, in order to assure that the projected 'build-out' hurricane evacuation traffic entering on U.S. 1 will not increase. Concurrent policies address restrictions on population density "in order to avoid further burdens on the hurricane evacuation plan".
- Plan policies advocate no City expenditures for infrastructure in the V zone that would encourage increased private development.
- The City of Key Colony Beach Disaster Preparedness Committee, composed of residents and City representatives, coordinates with the County on emergency management activities such as planning, response, recovery, and mitigation. It provides its own public information program, disaster command center, and emergency supplies.
- Post-disaster redevelopment is addressed in the Coastal Management Element of the Comprehensive Plan, recognizing that redevelopment may require greater building setbacks and elevations, and installation of dunes rather than seawalls.
- The Building Code requires buildings to be designed to withstand the forces of 150 mph winds (assumed in any direction and without regard to the effects of shielding of other structures).
- Post-disaster assessments are required by the Building Department to determine whether demolition versus repairs are appropriate given the level of damage; buildings damaged more than 50% must be rebuilt to current codes.
- The Land Development Code requires that all existing mangroves be maintained to state requirements; use of seawalls is restricted; new oceanfront development shall include dune planting plans.

Key Colony Beach participates in the Community Rating System (CRS) of the National Flood Insurance Program. The CRS recognizes actions that exceed the minimum requirements. In return, the City's property owners enjoy a 10% reduction in the cost of NFIP flood insurance. Actions undertaken by the City include:

- Maintains elevation certificates

- Makes NFIP map determinations
- Sends annual NFIP mailings to all local lenders, realtors, and insurance companies
- Keeps NFIP library in City Hall
- Constructs stormwater facilities
- Warns citizens of impending flooding

Recent Projects

- Since Hurricane Andrew, the City has reconstructed its causeway bridge to improve its ability to withstand storm surge.
- The City has its own sewage collection and treatment system, which is operated by the Wastewater Treatment Plant Operator. The sewage treatment plant is subject to storm surge flooding but has been recently retrofitted and operating at 2010 requirements. A generating system has been added for emergency operation and all of our effluent is converted to potable irrigation through our reverse osmosis and storage system. All lift stations and lines are continually being retrofitted and monitored for infiltration.
- The entire City Hall/Post Office complex has been retrofitted and floodproofed to current requirements.
- Several properties were purchased by the City and converted to open space.
- The City's master storm water control project that includes swales, retention ponds, and deep injection wells which were designed, installed, and monitored by the South Florida Water Management District, FL Department of Environmental Protection, and the U.S. Environmental Protection Agency. As of this date, the citywide project is approximately 50% complete.

Chapter 11: Islamorada Village of Islands

11.1 Overview of Islamorada

[XX *As of June 2005, Islamorada has not completed review and update of this text, which is based primarily on the 1999 LMS.*

The Islamorada Village of Islands, incorporated in 1997, is located in the Middle Keys between Mile-Markers 72.4 and 90.8. Known as "the Fishing Capital of the World," Islamorada's sport and commercial fishing industries are important to the local economy.

11.1 Overview of Islamorada

Geography

Islamorada comprises 3,900 acres in area. Islamorada is low-lying with numerous canals, cuts and inlets. All land below about XX feet above mean sea (MSL).

Population

Islamorada has a permanent resident population of 7,600. The seasonal population increases to as much as 8,600. Current population projects indicate the permanent population may grow to ____ by 2010.

Land Use & Economy

Much of the Village is developed with a mix of Single family residences, multi-family dwellings, time-share and seasonal units, tourists lodging (hotels, motels, inns, bed & breakfasts), commercial (restaurants, retails sales, banks), professional offices (Realtors, medical), marine, recreational and tourist oriented, and government uses.

[XX *this text has not been approved – please confirm (and fill in the blank)* Future growth is limited through the Rate of Growth Ordinance to implement portions of the City's Comprehensive Plan. ROGO, as the ordinance is called, establishes a building permit allocation system for residential construction. The purpose is to encourage in-fill of platted lots served by existing infrastructure and to limit growth to enable safe and timely hurricane evacuation. Pursuant to ROGO and an agreement between the City, County and the department of Community Affairs, the annual allocation for Islamorada is ____[how many?] permits per year for residential dwelling units.

Four sites are listed by the Historic Florida Keys Foundation, Inc., or are listed on the National Register of Historic Places: Windley Key Fossil Reef State Geological Site; Hurricane Monument (MM 81.5); Indian Key; and Lignum Vitae Key.

The Village joined the National Flood Insurance Program in October 1998 and administers a floodplain management ordinance that meets or exceeds the minimum federal requirements.

11.2 Village Organization and Agencies

Islamorada's Village Council is composed of 5 members, including the Mayor who is elected specifically to that office. The Village Council sets government policy and adopts guidance documents, such as the Comprehensive Plan, Land Development Regulations, and ordinances establishing various codes and standards.

Islamorada is organized into several agencies, each with authorized responsibilities that, as described below, have bearing on how natural hazards are recognized and addressed.

Village Manager. The Village Manager implements the policies of the Commission and administers the overall operations of the City. In fulfilling these duties, the Village Manager:

Planning Department. The Planning Department is responsible for the development and maintenance of the City's Comprehensive Plan.

Building & Code Enforcement. The Board reviews construction plans, issues permits, and inspects projects for compliance. Islamorada has adopted the Florida State Building Code. The Department is responsible for enforcing zoning and building standards, including those related to wind resistance and floodplain management.

Table 11-1. Permits Issued & Inspections Conducted (20XX, 20XX)

	Year 20XX	Year 20XX3
New single-family (Market Rate & Affordable)		
Transient Residential Use		
Building Permits		
Electric Permits		
Plumbing Permits		
Mechanical Permits		
Number of inspections		

11.3 Hazards and Risk in Islamorada

Historic Storms

The landfall location for the strongest hurricane recorded, the "Labor Day Storm" of 1935, made landfall at Islamorada. It is remains one of the most intense, costliest, and deadliest hurricanes. Winds were estimated at 120 mph with gusts from 190-210 mph. Tide levels ranged from 14 feet above MSL in Key Largo to 18 feet above MSL at Lower Matecumbe Key. Despite its ferocity, it was a small storm causing water levels at Key West to rise only two feet above MSL and sustained winds of less than 40 mph.

Other significant storms:

- Hurricane Donna (August 29-September 19, 1960). A Category 4 hurricane, this storm is listed among the most intense in U.S. history. It curved northwestward over the Middle Keys before turning north towards the mainland at Naples and Fort Myers. Wind speeds of 128 mph and central pressure of 28.44 inches were measures. Tide levels ranged from 13.5 feet above MSL ocean side at Islamorada (MM 80-83), +10 feet MSL ocean side Upper Matecumbe Key (MM 83-84) and 9-10 feet MSL Bay side.
- Hurricane Betsy (August 26-September 12, 1965). A Category 3 hurricane, Betsy passed over Marathon moving westward into the Gulf of Mexico. At Tavernier, central pressure was recored at 18.12 inches and wind speeds were estimated at 120 mph. Flood levels were measures at 9 feet MSL in Key Largo.
- Hurricane Georges (September 25, 1998). Near Islamorada at Mile-Marker 76.8, water rose to 4.5 feet above MSL and 6.1 feet at Mile-Marker 77.8. Near Mile-Marker 84, the highway was affected by flooding, downed trees and damage to road signs. Some beach erosion occurred.

Effect of Recent Hurricane Disasters

Damage from Hurricane Georges is representative of Islamorada's exposure:

- Debris Removal $2.5 million
- Emergency Labor and Supplies $12,000
- Manning of EOC and Search and Rescue $8,000
- Waste Water Treatment System Repairs $10,000
- Storm Water Systems Repair $10,000

Private property damage totaled approximately $5 million minimum (wind and flood). The following is an account of damage Islamorada Village of Islands as reported in a special edition of the Miami Herald, September 27, 1998:

- Lower Matecumbe Key – Storm surge cut across the highway covering it with sand, chunks of concrete, seaweed, and wood pilings. Bulldozers have cleared a pathway for emergency vehicles. Water rose more than a foot high in some homes.
- Windley Key – Holiday Isle Marina undamaged, but oceanside docks and tiki huts were mostly destroyed. Rooftop air conditioning unit at the Dive and Swim Center was damaged.
- Islamorada – Shoreline Motel lost 50-foot section of aluminum facing from the roof. An oceanside cottage at Cheeca Lodge (MM 82) lost some roofing. At Island Christian School, a large ficus toppled and crushed a chain link fence.
- Plantation Key – Many mobile homes flooded at Ocean San Pedro Trailer Park.

All businesses were closed or severely restricted from operating due to structural damage and power outages. Businesses related to tourism and fishing and marine activities were most affected by Georges.

Hurricane Flooding as Predicted by SLOSH Modeling

The National Hurricane Center's surge model, called SLOSH (Sea, Lake, and Overland Surges from Hurricanes), estimates surges associated with different characteristics of tropical cyclones (track, forward speed, wind speed, etc.). The results can be combined with topographic mapping to delineate inland areas subject to flooding (with a margin of error of +/- 20%). Table 11-2 shows the storm surge predications for four locations in Islamorada (Islamorada MM82, Islamorada MM 83.5, Plantation Key MM 88.5, and Plantation Key MM 90).

Table 11-2. SLOSH Maximum Predicted Water Depths above MSL

Islamorada Mile-Marker 82 Ocean Side						Islamorada Mile-Marker 82 Bay Side					
Track Direction	Storm Categories					Track Direction	Storm Categories				
	1	2	3	4	5		1	2	3	4	5
WSW	4	5	7	8	9	WSW	4	5	7	8	9
W	4	6	7	9	10	W	4	5	7	8	9
WNW	4	6	7	9	10	WNW	4	5	6	7	8
WN	4	6	7	9	10	NW	3	4	6	7	7
NNW	4	5	7	8	9	NNW	3	4	6	7	8

N	4	5	7	8	9	N	3	4	6	7	8
NNE	4	5	6	8	9	NNE	3	5	6	7	8
NE	4	5	6	7	8	NE	4	5	7	8	9
ENE	3	5	6	7	8	ENE	4	7	9	10	11
E	3	4	6	7	8	E	5	8	10	10	11

Plantation Key Mile-Marker 88.5 Bay Side						Plantation Key Mile-Marker 90 Ocean Side					
Track Direction	Storm Categories					Track Direction	Storm Categories				
	1	2	3	4	5		1	2	3	4	5
WSW	4	6	8	9	10	WSW	4	5	7	8	10
W	4	5	7	8	9	W	4	6	8	9	11
WNW	3	5	7	7	8	WNW	4	6	8	9	11
WN	3	5	6	7	8	NW	3	4	6	7	7
NNW	3	5	6	7	9	NNW	4	6	7	9	10
N	3	5	7	8	9	N	4	5	7	8	9
NNE	3	5	7	8	9	NNE	4	5	7	8	10
NE	4	6	8	9	1-	NE	4	5	6	8	9
ENE	5	8	10	12	13	ENE	4	5	6	8	9
E	6	10	11	12	13	E	3	5	6	7	8

NFIP Floodplain Mapping

The current effective Flood Insurance Rate Map, prepared by FEMA, is dated February 18, 2005. The FIRM delineates areas that have been determined to be subject to flooding by the "base flood," the flood that has a 1-percent-annual chance of flooding in any given year (commonly called the 100-year flood). The majority of land in Islamorada is subject to flooding; risk of individual buildings is a function of type of construction and elevation above grade. Areas noted as VE Zone, subject to high velocity wave action, are shown with flood levels ranging from 10 to 14 feet above MSL. Areas noted as AE Zone, where waves are expected to be less than 3-feet in height, flood levels are predicted to range from 6 to 10 feet above MSL.

NFIP Flood Insurance Policies in Islamorada: 2,766

Claims paid since 1978: 8

http://www.fema.gov/nfip/pcstat.shtm
(as of December 31, 2004)

The area along U.S. Route 1 and commercial properties that front on the highway, plus Plantation Key, Windley Key, and Upper Matecumbe Key, have ground elevations higher than the predicted 100-year flood elevation. Sections around Coral Shores High School are also shown as outside of the mapped floodplain.

NFIP Repetitive Loss Properties

Data provided by the Florida Department of Community Affairs identifies properties that are or have been insured by the National Flood Insurance Program and that have received two or more claims of at least $1,000. Within unincorporated Islamorada there are 3 repetitive loss properties (see Figure 7-1; based on data as of October 2003). The cumulative payments (claims paid on building damage and on contents damage) range from just over $19,000 to more than $111,000. [XX if any,

Islamorada's Important and Critical Facilities

Table 11-2 lists the City's important facilities (Figure 11-1 ??).

Table 11-2. Important and Critical Facilities in Islamorada

Critical/Essential Facilities: · Village of Islands Government Center · Monroe County Plantation Key Government Center · Monroe Sheriff's Sub-Station · Monroe County Plantation Key Public Works Complex · Islamorada Fire-EMS Station · Coral Shoals High School (County) · Plantation Key Elementary School (County)	**Other Facilities:** · Mariner's Hospital · U.S. Coast Guard Station · Plantation Key Convalescent Center · Florida Keys Electric Cooperative Sub-Station · Island Christian School · Florida Keys Children's Shelter
Hazardous Materials Sites (302 Facilities): · Bell South Telecommunications Facility	**Mobile Home and Recreational Vehicle Parks (as of October 1995):** · Village Mobile Home Park · Coral Bay Trailer Court · Key Lantern Travel Trailer Park · Pelican Palms Trailer Park · Howells Junction · Village Mobile Park · Mannon's Trailer Park · Peaceful Palms Mobile Homes (Windley Key) · Windley Key Trailer Park · Airstream Road (Plantation Key) · Sea Breeze Trailer Park (Plantation Key) · San Pedro Trailer Park (Plantation Key) · Plantation Tropical Park (Plantation Key)

Marinas:

- Papa Joe's Marina
- Bud N Mary's Marina
- Lew's Marina
- Max's Marine, Inc.
- Green Turtle Fish Market
- Islamorada Fish Company
- Caribe Boat Sales and Marina
- Cobra Marine, Snake Creek
- Coconut Cove Resort and Marina
- Coral Bay Marina
- Estes Water Sports and Marina
- Holiday Isle Resorts and Marina
- Islamorada Boat Center
- Islamorada Yacht Basin/Lorelei
- Matecumbe Marina
- Matecumbe Yacht Club
- Plantation Yacht Harbor Resort and Marina
- Robbies Marina
- Sea Isle Resort and Marina
- Smuggler's Cove Marina
- Whale Harbor Marina
- World Wide Sportsmen Marina
- Caloosa Cover Marina (Lower Matecumbe)

11.4 Damage Reduction Activities

On-Going Activities

[*XX add others*

The Village will be working with FEMA to correct illegal ground level construction in flood-prone areas.

[XX *this is from the 1999 LMS, may not longer be current?* Ordinance No. 98-04 provides for a building moratorium on commercial property, which will allow development of a Comprehensive Land Development Plan.

Recent Projects

[*XX this section is to list recent discrete projects to reduce damage, such as retrofits of specific public buildings and facilities (with or without FEMA funding; if with FEMA funding, provide amount and source (e.g., 406, HMGP, FMA*)

Chapter 12: City of Marathon

The City of Marathon, incorporated in November 1999, is located in the Middle Keys and consists generally of previously unincorporated areas of Monroe County known as Marathon, Marathon Shores, and Grassy Key. The corporate boundaries of the city are as follows:

"from the East end of the Seven Mile Bridge (approximately Mile Marker 47) to the West end of the Tom's Harbor Bridge (approximately Mile Marker 60), including, but not limited to, the entire islands of Knight Key; Hog Key; Vaca Key; Stirrup Key; Boot Key; Crawl Key; East Sister's Island; West Sister's Island; Fat Deer Key; Long Point Key; Deer Key; Little Deer Key; Little Crawl Key; Grassy Key; the unincorporated areas of Monroe County commonly known as Marathon and Coco Plum; all land filled in between the islands, including all islands connected by U.S. 1, Overseas Highway and roadways connecting thereto; and all adjacent islands not connected by roadways within the boundaries of Monroe County between Mile Marker 47 and Mile Marker 60, specifically excluding all areas within the boundaries of the City of Key Colony Beach, all of the above being within the boundaries of Monroe County, Florida."

12.1 Overview of Marathon

Geography

Marathon is situated in a precarious physical location between the Gulf of Mexico and the Atlantic Ocean. Marathon is approximately 8,320 acres consisting of a number of islands. Elevations in Marathon range from approximately 2 feet above mean sea level to approximately 7 feet above mean sea level.

Several keys make up the City and they vary greatly in size. Marathon is essentially a string of low coral islands with flat terrain. The long and narrow configuration creates a risk for storm surge from both sides of the island chain. Storm surge can be expected to be from 2 feet in a category 2 or 3 hurricane to as much as 14 feet in a category 4 or 5 hurricane. The City of Marathon would be flooded in a Category 4 or 5 hurricane, worst-case storm surge.

Marathon has no inland areas; all locations are equally vulnerable to high wind effects. The "friction factor", which causes winds from storms to decrease over land, does not apply in the Keys.

Population

According to the 2000 U.S. Census, The City Marathon has a permanent resident population of 10,255. The seasonal population increases by as much as 4,931. There are 6786 residential housing units of various configurations. Population estimates and projections to 2010 for the permanent residents estimate an increase to 10,496 and the seasonal population increase to 5,078 for a total of 15,574.

In 2004, the Monroe County Social Services registered 11 people in the Marathon area as having special needs for hurricane evacuation assistance.

Land Use & Economy

Marathon's development is a mix of single family residences, multifamily dwellings, tourist lodgings (hotels, motels, and destination resorts), tourist-oriented uses (museums, research center, attractions), marine-related and recreational uses, commercial uses (restaurants, retail sales, banks, Realtors), medical facilities and offices, and government uses.

Future growth is limited through the Rate of Growth Ordinance adopted by Monroe County in 1992 to implement portions of its Comprehensive Plan. ROGO, as the ordinance is called, establishes a building permit allocation system for residential construction. The purpose is to encourage in-fill of platted lots served by existing infrastructure and to limit growth to enable safe and timely hurricane evacuation. Pursuant to ROGO and an agreement between the City, County and the department of Community Affairs, the annual allocation for Marathon is twenty-four permits per year for residential dwelling units.

All new construction, reconstruction, and improvements to existing buildings must comply with the current building code requirements.

The City joined the National Flood Insurance Program in October 2000 and administers a floodplain management ordinance that meets or exceeds the minimum federal requirements.

Comprehensive Plan

The City of Marathon adopted its Comprehensive Plan in March 2005. The plan includes nine elements pertaining to the future growth and development the City. Throughout the plan are numerous goals, objectives and policies that acknowledge hurricane risks, especially related to evacuation, growth, ensuring safety, providing adequate facilities, managing stormwater, working with providers of water supply and wastewater services, and

requirement compliance with codes. The Infrastructure Element and the Conservation and Coastal Element contain specific policies relevant to mitigation of future risk and damage:

- The Infrastructure Element includes such mitigation policies as:
- Completing a detailed engineering study of drainage and implement priority storm water projects.
- On-site wastewater disposal facilities to minimize potential environmental impacts.
- Establish and coordinate acquisition programs.
- The Conservation and Coastal Element includes such mitigation policies as:
- New development encroaching into the 100-year floodplain shall incorporate elevation and flood protection measures sufficient to protect against the 100-year flood.
- The City shall maintain consistency with program policies of the National Flood Insurance Program.
- The City shall monitor new cost effective programs for minimizing flood damage.
- Such programs may include modifications to construction setback requirements or other site design techniques, as well as upgraded building and construction techniques. The City discourages development in the High Velocity Area and regulates redevelopment of structures non-conforming to the required base flood elevation.

12.2 City Organization and Agencies

City of Marathon is a Council Form of Government. The City Council is composed of 5 members, including the Mayor who is selected by the Council to that office. The City Council sets government policy and adopts guidance documents, such as the Comprehensive Plan, the Land Development Regulation and ordinances establishing various codes and standards.

Marathon is organized into several departments, each with authorized responsibilities that, as described below, have bearing on how natural hazards are recognized and addressed.

City Manager. The City Manager of Marathon implements the policies of the Council and administers the overall operations of the City. With regards to the floodplain management, the City Manager (or designee) is appointed to administer and implement these provisions consistent with the requirements of the National Flood Insurance Program.

Marathon Planning Department. The Marathon Planning Department is responsible for the development and maintenance of the City's Comprehensive Plan and the Land Development Regulations. Department personnel (Director, Planner, Planning Technician, Biologist) serve as staff to the City's Planning Commission and are involved in the following which are related to hazard mitigation:

- Ensures that mitigation related items in the Comprehensive Plan, such as floodplain management and natural resource management, are followed and reflected in the City's Codes and Standards.
- Participates in post-disaster appraisals and may formulate additional mitigation measures for use in the Comprehensive Plan.
- Works closely with the Building, Code Compliance, and Fire Department to ensure coordination of actions related to disaster planning, recovery, and mitigation.
- Reviews construction plans for compliance to the NFIP regulations.
- Responsible for enforcing planning and zoning standards.

Marathon Building Department. The Building Department is responsible for regulations of building construction pertaining to life safety, health, and environmental land use zoning regulations. The department is staff by the Building Official, a Building Inspector, Executive Plans Coordinator, and three Permit Clerks. Related to mitigation of hazards, the department is responsible for the following:

- Review of construction plans and issuing building permits.
- Inspection and enforcement during construction.
- Designated as coordinator for the National Flood Insurance Program.
- Assist the public in identifying and implementing flood damage prevention measures.
- Participate in post-disaster appraisals.
- Work closely with the Planning, Fire, and Code Compliance Department to ensure coordination of actions related to disaster planning, recovery, and mitigation.

Table 12-1. Permits Issued & Inspections Conducted (2002, 2003)

	Fiscal Year 2002	Fiscal Year 2003
New single-family (Market Rate & Affordable)	23	24
Transient Residential Use	N/A	69

Table 12-1. Permits Issued & Inspections Conducted (2002, 2003)

	Fiscal Year 2002	Fiscal Year 2003
Building Permits	904	910
Electric Permits	237	179
Plumbing Permits	163	418
Mechanical Permits	216	249
Number of inspections	2,366	4,783

Marathon Code Compliance Department. The Code Compliance Department oversees after-the-fact code compliance issues pertaining to safety, health, and environmental land use zoning regulations. The department is staffed by a Code Compliance Supervisor, a Code Officer, and an Administrative Assistant. Related to mitigation of hazards, the department is responsible for: working closely with the Building, Planning, and Fire departments to ensure coordination of actions related to disaster planning, recovery, and mitigation; and participating in post-disaster appraisals.

Marathon Finance Department. The Finance Department (contracted) is responsible for overseeing the day-to-day financial requirements of the City, including establishment of purchasing procedures for all agencies. To expedite preparation for, response to, and recovery from disasters, the Finance Department may implement special emergency procedures to expedite necessary purchase and payment before, during, and after a disaster.

Marathon Engineering Department. The Public Works Division works under the direction of the Engineering Department and is responsible for overseeing the maintenance of all city facilities, including buildings, roads, and bridges. It manages the stormwater program, including design and construction of stormwater facilities. The Department also operates and maintains City vehicles.

Public Works is responsible for coordination and provision of emergency public works, initial evaluation of infrastructure damage and preparation of documentation required for federal reimbursement (including identification of mitigation components to be incorporated during recovery), and coordination of emergency debris clearing.

In executing its disaster recovery responsibilities, Public Works coordinates with the Florida Department of Transportation, Monroe County Department of Public Works, Florida Keys

Aqueduct Authority, and Florida Keys Electric Co-op. The department plans, coordinates and initiates restoration of the serviceability of transportation routes, bridges, and assurance as to the safety of affected public and private dwellings and structures.

Monroe County Sheriff's Office: Marathon Division. The Sheriff's Office (contracted) is responsible for overall law enforcement and protection of residents and visitors in the City of Marathon. The department plays a key role in planning and response during emergencies to include but not limited to: coordination with Florida Highway Patrol to promote speedy and safe evacuation, communicates with base operations, field personnel, and emergency shelters.

Marathon Fire Department. The Fire Department provides emergency management assistance and direction to the City of Marathon for all life safety in connection with other duties of fire control, fire prevention, and fire and hurricane public education. The department plays a lead role in planning and response for all emergencies.

The department, as required under U.S. Homeland Security Presidential Directive 5, has adopted and uses the National Interagency Incident Management System (NIIMS) and will adopt the National Fire Service Incident Management System (IMS) Incident Command System (ICS) as the baseline incident management system. ICS is implemented for all fires, haz-mat incidents, rescues, structural collapse and urban search and rescue operations, manmade and natural disasters, and EMS responses that require two or more rescue companies.

12.3 Hazards and Risk in Marathon

Historic Storms that have affected the Marathon Area:

- 1929 Hurricane (September 22 to October 4) – The hurricane crossed over Key Largo on a northerly course. Key Largo reported winds estimated at over 100 mph, a central barometric pressure of 28 inches, and tide levels of 8-9 feet above MSL. Key West experienced tide levels of 5-6 feet above MSL and winds of 66 mph.
- 1935, Hurricane (August 29-September 10) - The small, extremely violent, Category 5 hurricane crossed the Florida Keys on a northwesterly track. The Tavernier-Islamorada area reported sustained winds estimated at 120 mph with gusts from 190-210 mph. Tide levels in the Florida Keys ranged from 14 feet above MSL in Key Largo to 18 feet above MSL in Lower Matecumbe Key. The storm was so intense and tightly wrapped that Key West had tide levels of only 2 feet above MSL and average sustained winds of less than 40 mph. One of the most tragic aspects of the 1935 storm was the unfortunate death of many

WWI veterans who were working on construction of Henry Flagler's Overseas Railroad.

- Hurricane Donna, 1960 (August 29-September 19) – Hurricane Donna curved northwestward over the Middle Keys near Long Key/Layton and then traveled northward toward the Gulf Coast towns of Naples and Fort Myers. Areas in the vicinity of the storm experienced winds speed of 128 mph and a central pressure of 28.44 inches. The storm affected the Everglades with estimated winds of 150 mph. Tide levels were reported at Upper Matecumbe Key of 13.5 feet above MSL, at Plantation Key 10+ feet above MSL, and 8.9 feet above MSL in Key Largo. As of 1992 Hurricane Donna, a Category 4 storm is listed as the 6th most intense hurricane in the US.
- Hurricane Betsy, 1965 (August 26-Septmber 12) – Hurricane Betsy passed over Marathon while moving westward into the Gulf of Mexico. The lowest central pressure was measured in Tavernier at 28.12 inches and wind speeds were estimated to be 120 mph. Tide levels in Tavernier were 7.7 feet above MSL and Key Largo had tide levels of around 9 feet above MSL. Betsy was a Category 3 storm and is ranked 25th in intensity.
- Ground Hog's Day Storm (February 2, 1998) involved multiple F-2 tornado touchdowns resulting from a severe thunderstorms characterized by dangerous cells with high, cold cloud tops affected the Florida Keys. Areas most affected were primarily in the Middle Keys including Grassy Key and Valhalla Beach in the vicinity of Duck Key. Several buildings were damaged. Also significant problems occurred from the displacement of lobster traps which contributed to seaborne debris and navigational problems; the fishing industry suffered considerable loss of income.
- Severe thunderstorms (July 4, 1998). Severe thunderstorms with lightning and high winds came up quickly in the Middle Keys. The Weather Service Office in Key West recorded wind speeds up to 70 mph sustained. Because it was July 4th, many boats were offshore celebrating and waiting for the fireworks. Although, this event did not warrant a presidential disaster declaration, it did result in loss of life.
- Hurricane Georges, 1998 (September 25, 1998), a Category 2 when made landfall in the Lower Keys, affecting the entire county to some extent. Damage estimates approached $300 million, including insured and uninsured damage and infrastructure loss. Maximum sustained winds at the Naval Air Station (Boca Chica) near Key West were 92 mph; gusts up to 110 mph were reported by the Emergency Operations Center in Marathon. According to the Key West Weather Service, precipitation levels in the Lower Keys were as 8.65 inches on the south side of Sugarloaf Key, 8.38 inches at Key West International Airport, and 8.20 inches on Cudjoe Key. Tavernier in the Upper Keys recorded 8.41 inches.
- Tropical Storm Mitch, 1998 (November 4 and 5). Feeder bands from Mitch containing dangerous super cells spawned several damaging tornadoes in the

Upper Keys. Sections with mobile homes were especially hard hit. Islamorada experienced an F-1 tornado; Rock Harbor and Key Largo were hit by F-2 tornadoes. According to the Department of Community Affairs, damages were estimated at $11 million.

- Hurricane Irene, October 1999. Hurricane Irene hit the Florida Keys and Southeastern Florida. This Category 1 Hurricane dumped 10 to 20 inches of rain resulting in severe flooding in the Florida Keys and Southeastern Florida causing total damage estimated at $800 million
- Tropical Storm Gabrielle, September 2001. Although it did not reach hurricane strength, this storm hit the southwest coast of Florida and caused flooding problems; Marathon did see some effects from the storm.

Hurricane Flooding as Predicted by SLOSH Modeling

The National Hurricane Center's surge model, called SLOSH (Sea, Lake, and Overland Surges from Hurricanes), estimates surges associated with different characteristics of tropical cyclones (track, forward speed, wind speed, etc.). The results can be combined with topographic mapping to delineate inland areas subject to flooding (with a margin of error of +/- 20%). The predicted storm surges at mile markers close to the Marathon area for various storm categories and tracks are shown in Table 12-2.

Table 12-2. SLOSH Maximum Predicted Water Depths above MSL

Ocean Side Mile-Marker 50						Ocean Side Mile Marker 61					
Track Direction	Storm Categories					Track Direction	Storm Categories				
	1	2	3	4	5		1	2	3	4	5
WSW	4	5	6	7	8	WSW	4	5	6	7	8
W	4	5	7	8	9	W	4	5	7	8	9
WNW	4	6	7	8	9	WNW	4	6	7	9	10
WN	4	6	7	8	9	NW	4	5	7	8	10
NNW	4	5	7	8	9	NNW	4	5	7	8	9
N	4	5	7	8	9	N	4	5	6	8	9
NNE	4	5	6	7	9	NNE	4	5	6	8	9
NE	4	5	6	7	8	NE	4	5	6	7	9
ENE	3	5	6	7	8	ENE	3	5	6	7	8
E	3	4	5	6	7	E	3	4	5	6	8

NFIP Floodplain Mapping

The National Flood Insurance Program (NFIP) prepared a Flood Insurance Rate Map for Monroe County (current effective map is dated February 18, 2005). The FIRM delineates areas that have been determined to be subject to flooding by the "base flood," the flood that

has a 1-percent-annual chance of flooding in any given year (commonly called the 100-year flood).

The entire City is located in areas designated as VE Zones (coastal flood with velocity hazard wave action) and AE Zones (areas subject to flooding but waves are predicted to be less than 3-feet in height). As such, all new development in the City is subject to the floodplain management standards established in the City's Land Development Regulations.

NFIP Flood Insurance Policies in Marathon
2,682

Claims paid since 1978: 0*

http://www.fema.gov/nfip/pcstat.shtm
(as of December 31, 2004)

*records prior to incorporation included in claims for Monroe County

NFIP Repetitive Loss Properties

Data provided by the Florida Department of Community Affairs identifies properties that are or have been insured by the National Flood Insurance Program and that have received two or more claims of at least $1,000. Within unincorporated Marathon [XX *complete this text if the GIS plot indicates any are within corporate boundaries (some of the NFIP's older records predate Marathon's incorporation); if yes, refer to Figure 7-1*

Severe Storms, Tornadoes, Water Spouts and High Winds (Other than Hurricane)

Marathon, like the rest of the Keys, has low-lying terrain. Section 6.2 characterizes the entire area encompassed by Monroe County and the cities as having equal distribution of winds. The risk of severe storms, tornadoes, water spouts and high winds in Marathon does not vary from the rest of the planning area. All new buildings, replacement buildings, and additions to existing buildings must comply with the Florida Building Code's wind load requirements.

Rainfall/Ponding Flooding

Unlike most areas in Monroe County and the other cities, Marathon has areas that are subject to rainfall or ponding flooding. This type of flooding results from longer duration storms, which occur almost annually. As a result, residents experience access problems and water has damaged some older, non-elevated, buildings. The area with the most significant problem is 107th Street to 109th Street. Access to about 200 buildings is limited during heavy and prolonged storms. While many of the buildings are elevated, about 50 older buildings are built on-grade and have experienced flooding. In Hurricane Georges, water up to one-foot deep caused damage.

Marathon's Stormwater Management Master Plan, prepared in 2002, identifies areas of localized flooding and a generalized overview of suggested methods to minimize local flooding such as closed drainage systems, exfiltration/slab covered trenches, and injection wells. The City has instituted a stormwater fee which will support continued evaluation, engineering and construction of drainage improvements.

Because all of Marathon is mapped as Special Flood Hazard Area, all new buildings and replacement buildings must comply with the floodplain management ordinance and be elevated or floodproofed (nonresidential only). Therefore, this type of flood damage is unlikely to affect buildings built in the future.

Marathon's Engineering Department, responsible for roads and drainage, designs all new and improved storm drainage facilities to hand the 25-year frequency rainfall.

Drought Hazards

Drought hazards for the planning area are described in Section 6.6. Marathon's risk due to drought is comparable the drought risk throughout the area.

Wildland Fire Hazards

The Florida Forestry Department indicates that in Marathon and Key Colony Beach, Grassy Key (including Geiger and Boca Chica) is the area that is most prone to wildland or brush fires. Based on data provided by Monroe County Property Appraiser, Grassy Key includes a total of 9,391 parcels of land of which 6,498 are improved. The total assessed value of improvements is $1,562,786,704. It is important to note that this summary is not to imply that all properties would be vulnerable in any given wildfire outbreak. Future development on Grassy Key is influenced by ROGO and property owner choices; all new construction must comply with environmental restrictions.

Marathon's Critical and Important Facilities

Table 12-3 lists the City's important facilities (XX *if we get a map from GIS to show some of these, refer to it here*).

Table 12-3. Critical and Important Facilities

Critical/Essential Facilities:

- City Hall
- Fisherman's Hospital
- Florida Keys Electric Co-op
- Schools (Stanley Switlick, Marathon Middle, and Marathon High)
- Marathon Airport
- City Marina
- Nursing Home
- Florida Keys Aqueduct Authority
- Crawl Key Sewer Treatment Plant (future)
- Fire Station #14
- 33rd Street Fire Station (future)
- Monroe County Operation Center
- Little Venice Sewer Treatment Plant

Hazardous Materials Sites (302 Facilities):

- Per Comprehensive Plan policy 3-3.3.1, the City will identify Hazardous Material Locations

Marinas: (from the draft Marine Siting Plan)

- 7 Mile Grill
- Abaco Sails & Marine
- Banana Bay Marina
- Blackfin Resort and Marina
- The Boat House
- Bonefish Bay Motel
- Bonefish Yacht Club and Marina
- Boot Key Harbor City Marina
- Border Patrol
- Burdines Water Front
- Cannon Marine & Harbor Point
- Captain Hook's Marina
- Captains Three Fisheries
- Coco Plum Marina & Storage, Inc.
- Coconut Cay Resort & Marina
- Coconut Palmas, Inc.
- Coral Island Yachts

Table 12-3. Critical and Important Facilities

Mobile Home and Recreational Vehicle Parks (as of January 2005): • Aloha Trailer Park • Farnsworth Trailer Park • Galway Bay RV and Mobile Home Park • Jolly roger Travel Park • Key RV Park • Knights Key Campground • Lion's Lair Travel Park • Ocean 25 Company, Inc. • Ocean Breeze Park West • Ocean Breeze Trailer Park • Old Towne Village • Palms Subdivision Trailer • Pelican Motel & Trailer Park • Sundance • Terra Marine Park • Trailer Ranch by the Sea • Trailerama Park • Whispering Pines • Trailers by the Sea	• Crystal Bay Resort & Marina • D & D Seafood • Driftwood Marina & Storage • Faro Blanco Resort Gulfside • Faro Blanco Resort Oceanside · Galway Bay Trailer Park and Marina · Grassy Key Marina of Marathon · Hidden Harbor · Holiday Inn · Jolly Roger RV Park · Keys Boat Works, Inc. · Keys Fisheries Market & Marina · Keys Fisheries (Joe's Stone Crab) · Kingsail Resort Motel · Knight's Key Campground · Lion's Lair RV Park · Marathon Marina & Boat Yard · Marathon Yacht Club · Marie's Yacht Harbor & Marina · Ocean Breeze RV Park & Marina · Oceanside Marine Service, Inc. · Outta The Blue Marina · Pelican Resort · Pancho's Fuel Dock · Rainbow Bend Resort & Marina · Royal Hawaiian Motel/Botel · Sea Cove Motel · Seascape Resort · Seven Mile Marina · Shelter Bay Marine · Sombrero Marina & Dockside · Sombrero Resort Lighthouse Marina · Vaca Key Marina · Valhalla Beach · Yardarm Motel

12.4 Damage Reduction Activities

On-Going Activities

- 107th to 109th Street Stormwater Improvement Project: includes the installation of drainage and retention structures to minimize the impacts from rainfall/flood events with a 25-year frequency. (Construction expected 2005/2006)
- West 105th to 116th Street Stormwater Improvement Project: includes the installation of drainage and retention structures to minimize the water quality

impacts from rainfall/flood events with a 25-year frequency. (Construction expected 2005/2006)

Recent Projects

These projects are intended to reduce rainfall/ponding flooding and improve overall drainage and water quality of stormwater runoff:

- Sombrero Beach Injection Well: under drain in the park area leading to a 24' injection well in the parking lot. (Completed September 2004)
- 39th Street Drainage Improvements: was designed to improve existing drainage conditions at the location of 39th Street (2nd Ave), which will provide a means for discharge through two drainage wells and thereby allow bleed-down of the ponding areas. Because the wells will serve as a source for discharge during storm events, the proposed system will help to alleviate the extent of ponding. Runoff will be collected through a series of inter-connected swales, ditches and bubble up structures and converged to two drainage wells. (Completed March 2005)
- 20th Street Gulf (Boot Key Road): designed to improve existing drainage conditions on 20th Street Gulf. The work included grading shoulders, grading the drainage swales at north end of the project, place drainage structures on both sides of the road and 100 linear feet of French Drain. (Completed March 2005)
- 4th Ave Gulf Drainage: designed to improve existing drainage conditions on 4th Ave Gulf. The work included installing a catch basin at the low point of the intersection; 15" pipe installed across 4th Ave to 24" injection well. (Completed March 2005)
- 46th Street Gulf: designed to improve existing drainage conditions on 46th Street Gulf. The work included installing a catch basin and 150 linear foot French drain at the low point of the road. (Completed March 2005)
- 42nd Street Gulf: designed to improve existing drainage conditions on 42nd Street Gulf. The work included installing a catch basin and 150 linear foot French drain. (Completed March 2005)
- Ave D Drainage: designed to improve existing drainage conditions on Ave D. The work included installing a 24" Injection well and one double chamber Baffle Box. (Completed March 2005)

References:

City of Marathon, Comprehensive Plan (2005).

City of Marathon, Stormwater Management Master Plan (October 2002). Calvin-Giordano & Associates.

Chapter 13: Mitigation Initiatives

Hurricanes and their associated hazards (high wind and surge flooding) are described in Chapter 5 and other hazards are overviewed in Chapter 6 (severe storms/tornadoes, rainfall/fresh water flooding, drought and wildland fire). For the purposes of actively pursuing damage reduction activities, the Monroe County LMS Work Group determined that it is appropriate to focus on the hazards that have relative vulnerability ranking of "high" and "moderate" (Table 13-1). Ongoing activities related to tornadoes (monitoring and warning) and wildfire (cooperation with State services, maintaining fire suppression capabilities) will continue.

Table 13-1. Hazards: Relative Vulnerability

Hazard	Vulnerability
Hurricane/Tropical Storm	High
Flooding (rainfall ponding)	High (locally)
Tornado	Moderate
Wildfire	Moderate

13.1 Range of Mitigation Initiatives

In the State Mitigation Plan the Florida Department of Community Affairs uses six general categories or approaches to mitigation (Table 13-2). The members of the Monroe County LMS Work Group considered these categories when identifying initiatives within their jurisdictions.

Table 13-2. Categories of Mitigation Initiatives.

PREVENTIVE MEASURES keep problems from getting started or getting worse. When hazards are known and can be factored in to development decisions early in the process, risks are reduced and future property damage is minimized. Building, zoning, planning, and/or code enforcement officials usually administer these activities: • Planning and zoning • Open space preservation • Building codes and enforcement • Infrastructure design requirements
PROPERTY PROTECTION measures are actions that go directly to permanently reducing risks that are present due to development that pre-dates current codes and regulations and include: • Property acquisition in floodplains • Relocation out of hazard-prone areas • Elevation of structures in floodplains • Retrofit of structures in high wind zones

Table 13-2. Categories of Mitigation Initiatives.

EMERGENCY SERVICES MEASURES are taken immediately before or during a hazard event to minimize impacts. These measures are the responsibility of city or county emergency management staff, operators of major and critical facilities, and other local emergency service organizations and include: • Alert warning systems • Hazard/weather monitoring systems • Emergency response planning • Evacuation • Critical facilities protection • Preservation of health and safety
STRUCTURAL PROJECTS are usually designed by engineers and managed and maintained by public entities. They are designed to reduce or redirect the impact of natural disasters (especially floods) away from at-risk population areas: • Levees, floodwalls, dunes and berms • Drainage diversions • Storm water management facilities
NATURAL RESOURCE PROTECTION projects preserve or restore natural areas or their natural functions. Park and recreation organizations, conservation agencies or wildlife groups may implement such measures: • Wetland protection or restoration • Beach and dune protection • Erosion and sediment control
PUBLIC INFORMATION PROGRAMS advise property owners, potential property owners, and others of prevalent hazards and ways to protect people and property. A public information office usually implements these activities, often with private partner support: • Flood maps and data • Public information and outreach • Technical assistance for property owners • Real estate disclosure information • Environmental education programs

13.2 Mitigation Initiatives

Elements of the Monroe County LMS Goals highlight the importance of reducing potential damage to critical facilities (public schools and public buildings, infrastructure (power, water, sewer, communications, roads and bridges), and the economy, including damage to privately owned homes and businesses. Progress is made toward those goals through implementation of mitigation initiatives.

It is important to recognize and acknowledge that Monroe County and the cities all have on-going programs and activities that contribute to disaster resistance even if those actions were not initiated in response to the Local Mitigation Strategy process. For example, every jurisdiction issues building permits and administers a floodplain management ordinance. New buildings and infrastructure must comply with current FBC and regulations which are deemed to be sufficient to minimize future damage to due hurricanes, high winds and flooding. Every jurisdiction maintains its roads, which reduces the likelihood of washout damage. Key West and Marathon pursue projects to improve drainage in areas subject to rainfall flooding.

Monroe County and the cities participate in public information and outreach, encouraging residents and visitors to be aware of the potential for hurricanes and actions to take both to reduce property damage and to facilitate safe evacuation.

Similarly, the utilities have on-going responsibilities intended to reduce the impacts of natural hazards. The Florida Keys Aqueduct Authority has contingencies for drought. The Florida Keys Electric Cooperative, the Key West City Electric System, and Florida Power and Light take steps to minimize damage to their infrastructure and distribution systems to be able to recover as quickly as possible after hurricanes.

13.3 Initiatives for Work Group as a Whole

The Monroe County LMS Work Group identified two programmatic initiatives that relate to improving its own functions and responsibilities and one initiative that involves all jurisdictions to improve NFIP data on repetitively-flooded properties (Table 13-3).

Table 13-3. High Priority Mitigation Initiatives: Work Group

Initiative	Complete Critical Facilities Spreadsheet
Jurisdiction/Entity	Monroe County and cities of Key West, Marathon, Key Colony Beach, Layton, and Islamorada; all participating non-profit entities/utilities
Description	The Work Group determined the nature of data that, ideally, is valuable to have to help identify facilities that are expected to perform well and to identify vulnerabilities that may indicate opportunities for mitigation. The spreadsheet in Appendix A is designed to help entities collect the data. As part of the annual LMS update, participants will review and update the data to reflect changes.
Hazards	All
Potential Funding Sources	Staff time

Table 13-3. High Priority Mitigation Initiatives: Work Group

Estimated Time Frame	By December 31, 2006
Initiative	**Revise Scheme to Prioritize Initiatives**
Jurisdiction/Entity	Monroe County and cities of Key West, Marathon, Key Colony Beach, Layton, and Islamorada; all participating non-profit entities/utilities
Description	The Work Group's experience with the previously-adopted process for the 2005 HMGP applications indicated a need to modify the process by which potential mitigation initiatives are submitted and, when funding becomes available, how the Work Group establishes priorities among the initiatives that proponents wish to submit for funding. At the May 24, 2005 Work Group meeting it was determined appropriate to develop a two-step process. This initiative will complete development of the forms and scheme that will be used to prioritize initiatives when future funding becomes available (which will be inserted in Appendix D). This action also involves completion of the tracking spreadsheet with data deemed appropriate by each entity (Appendix C).
Hazards	All
Potential Funding Sources	Staff time to participate in Work Group
Estimated Time Frame	By December 31, 2005
Initiative	**Verify and Improve Repetitive Flood Loss Data**
Jurisdiction/Entity	Monroe County and cities of Key West, Marathon, Key Colony Beach, Layton, Islamorada
Description	The National Flood Insurance Program maintains records of past flood insurance claims and tracks properties that have received multiple claims (referred to as "repetitive loss" properties). These properties present likely opportunities for mitigation, such as elevation-in-place, and FEMA funding may be available to support cost-effective measures. The NFIP records date to the mid-70s and are known to contain inconsistencies. Verifying the data serves two purposes: it helps the NFIP improve its records, and it results in an accurate list of the area's most flood-prone properties. Owners of these properties may be interested in reducing their exposure and working with the communities to seek mitigation funds.
Hazards	Flooding (surge and ponding)
Potential Funding Sources	Staff time for data verification
Estimated Time Frame	By December 31, 2007

13.4 Community-Specific Initiatives

Table 13-4. High Priority Mitigation Initiatives: Key West

Initiative	Seek Reinstatement in the NFIP's Community Rating System
Jurisdiction/Entity	City of Key West
Description	With 8,345 NFIP flood insurance policies, Key West property owners will benefit if the City achieves reinstatement in the CRS (savings of 5% of current paid premium amount is $312,000).
Hazards	Flood
Potential Funding Sources	Staff time
Estimated Time Frame	By December 31, 2006

13.5 Site-Specific Initiatives

Mitigation projects or initiatives are actions that focus on specific locations such as public buildings, public infrastructure, or privately-owned property. Examples of project initiatives that have been or are likely to be implemented in Monroe County and the cities include, but are not limited to:

- Wind retrofit of public buildings and facilities.
- Wind retrofit of private non-profit buildings and low income homes.
- Installation of storm drainage improvements.
- Floodproofing of public buildings and facilities.
- Elevation or acquisition of private homes in floodplains.

The Monroe County LMS Work Group maintains an evolving list of project initiatives (Appendix C). This list may be modified periodically upon action by the Work Group. The list has three distinct parts that result from distinct steps in the process:

- **Step One: Preliminary Identified Mitigation Initiatives** (which are placed on the list with a minimum amount of information, see Section 13.5).
- **Step Two: Prioritized Mitigation Initiatives** (which have sufficient detail that an overall ranking can be performed, see Section 13.5).
- **Step Three: Completed Mitigation Initiatives** which have been undertaken, with or without external funding).

13.6 Prioritizing Mitigation Initiatives

Florida Rule 9G-22 delegates to the LMS Work Group the authority to set priorities and identify projects. DCA encourages Work Groups not only to pre-identify projects but to gather initial data to facilitate the priority setting process in part to help with more rapid consideration in the post-disaster period. Because long periods of time may elapse between initial identification of an initiative and application for funds, detailed cost estimates or engineering are not necessary for the purpose. Initiative proponents are responsible for providing information on which the prioritizations are based.

The Monroe LMS does not outline how each jurisdiction or nonprofit organization decides to prioritize its own projects. It is expected that initiatives will be identified based on available hazard information, past hazard events, the number of people and types of property exposed to those hazards, and the feasibility and cost-effectiveness of the measure. Initiatives are expected to be consistent with current policies and regulations, technically feasible, likely to have high political and social acceptance, and achievable using existing authorities and staff.

The Work Group adopted a phased process for identification and prioritization of mitigation initiatives that results in the evolving list of initiatives in Appendix C. This list is maintained by Monroe County Emergency Management on behalf of the Work Group.

Step One: Preliminary Identified Mitigation Initiatives

Initiatives may be placed on the list by any eligible entity that provides minimum information. The Work Group anticipates allowing submission on a quarterly basis so that eligible entities are not constrained by an annual opportunity to identify and pursue projects and funding. To be placed on the list, the following minimum information will be required:

- Name of owner/entity;
- Name and location of project/building;
- Brief description of project and need and the hazard and problem(s) it would address; and
- Rough cost estimate based on the best available information, including a description of how the estimate was made. This estimate is explicitly not intended to be used for the benefit:cost analysis (see Step Two).

Section 13.3 identifies a high priority action for the Work Group to improve its processes. As part of that action, the information that is required to submit an initiative may change.

When that action is completed, a form for submittal will be prepared and inserted in Appendix D.

Step Two: Prioritized Mitigation Initiatives

A project that is on the Step One list is moved to the Step Two priority list when the owner/entity is prepared to develop and submit the formal application to DCA and FEMA and when the Work Group is charged with prioritizing projects for available funding. Notices of Funding Availability may be issued annually, e.g., for FEMA's Flood Mitigation Assistance Program or the Pre-Disaster Mitigation Program. After disasters that yield Hazard Mitigation Grant Program funds, Notices of Funding Availability usually are issued within 90 days. Whether on an annual basis or post-disaster, the Work Group would be notified and eligible entities would then decide whether they are prepared to formalize initiatives that are on the Preliminary List.

Pursuant to State law (Chapter 9G-22.006) the LMS Work Group is charged with developing a prioritized list of initiatives. At any given time, priorities may change due to various factors such as recent damage, availability of non-federal cost share, or changes in priorities of the funding agency.

When a Notice of Funding Availability is anticipated or received, the LMS Coordinator will notify entities that have initiatives in the Step One list. In order to have an initiative forwarded to the funding agency, detailed data are required so that the Work Group can process and determine priorities (Step Two list). The following minimum information will be required:

- Name of owner/entity and the point of contact responsible for providing the detailed information;
- Name and location of project/building;
- Detailed description of project (scope of work) and need, and the hazard and problem(s) it would address;
- Explanation of how the initiative satisfies the Mitigation Goals (see Section 4.2);
- Number and description of the population served;
- Project costs and a description of how those costs were estimated;
- Description of project benefits, including how benefits can be quantified;
- Description of economic, social, and environmental benefits;
- Estimate of period of time the project is expect to take to complete; and

- A statement regarding availability of the non-federal cost share.

Section 13.3 identifies a high priority action for the Work Group to improve its processes. As part of that action, the information that is required in order for an initiative to be prioritized may be augmented. When that action is completed, a form for submittal will be prepared and inserted in Appendix D. Further, when that action is completed, the prioritization method that the Work Group adopts will be formalized (e.g., the factors and weights assigned to those factors) and inserted in Appendix D.

Step Three: Completed Mitigation Initiatives

In order to maintain records that demonstrate progress towards the Mitigation Goals, the Work Group recognizes that it is important to track completed initiatives, as well as initiatives that are removed from the list. At least once a year entities that have undertaken mitigation initiatives (regardless of source of funding) will report to the Work Group.

13.7 Potential Funding for Selected Initiatives

Funding to support mitigation initiatives may be available from several sources, each with its own timing and requirements. The list in Table 13-5 is not intended to be exhaustive, but to characterize the variety of funding. The LMS Work Group will endeavor to maintain familiarity with funding sources and availability. The Florida DCA is the primary contact for notifications and processing of federal funds, especially those that derive from the U.S. Department of Homeland Security (FEMA).

Table 13-5. Potential Funding for Mitigation

Program	Fund Source Contact
Hazard Mitigation Grant Program (HMGP) To prevent future losses of lives and property due to disasters; to implement State or local hazard mitigation plans; to enable mitigation measures to be implemented during immediate recovery from a disaster; and to provide funding for previously identified mitigation measures to benefit the disaster area. Eligible projects include: • Property acquisition or relocation • Structural and non-structural retrofitting (e.g. elevation, storm shutters and hurricane clips) • Minor structural hazard control (e.g. culverts, floodgates, retention basins) • Localized flood control projects that are designed to protect critical facilities and are not part of a larger flood control system • Other feasible and cost-effective measures Ineligible activities include:	Source: FEMA Contact: Florida Department of Community Affairs (DCA)

Table 13-5. Potential Funding for Mitigation

Program	Fund Source Contact
• Major flood control projects • Engineering designs not integral to a proposed project • Feasibility and drainage studies that are not integral to a proposed project • Flood studies that are not and mapping • Response and communication equipment (e.g., warning systems, generators that are not integral to a proposed project)	
Pre-Disaster Mitigation (PDM) Competitive Grants The PDM program was authorized by Section §203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended by Section §102 of the Disaster Mitigation Act of 2000, to assist communities to implement hazard mitigation programs designed to reduce overall risk to the population and structures before the next disaster occurs. Annual guidance is issued and may include national priorities. See HMGO for eligible activities.	Source: FEMA Contact: DCA
Flood Mitigation Assistance Program To fund cost effective measures implemented by States and communities to reduce or eliminate the long term risk of flood damage to buildings, manufactured homes, and other structures uninsurable by the National Flood Insurance Program. See flood-related activities under PDM.	Source: FEMA Contact: DCA
Community Development Block Grant The Community Development Block Grants (CDBG) provide for long-term needs, such as acquisition, rehabilitation or reconstruction of damaged properties and facilities and redevelopment of disaster-affected areas. Funds may also be used for emergency response activities, such as debris clearance and demolition, extraordinary increases in the level of necessary public services. Eligible projects include: • Voluntary acquisition or if appropriate, elevation of storm damaged structures (can be used as match for FEMA mitigation projects in low income areas) • Relocation payments for displaced people and businesses • Rehabilitation or reconstruction of residential and commercial buildings • Assistance to help people buy homes, including down payment assistance and interest rate subsidies • Improvement to public sewer and water facilities	Source: HUD Contact: Community Planning and Development
Community Facilities Loan Program (10.423) To construct, enlarge, extend, or otherwise improve community facilities providing essential services to rural residents.	Source/Contact: Florida Rural Economic and Community Development
Conservation and Recreation Lands (CARL) This grant program is intended to conserve environmentally endangered lands and provide resource conservation measures for other types of lands.	Source/Contact: Florida Department of Environmental Protection Division of State Lands
Florida Communities Trust (FCT) Facilitates the purchase of lands for conservation and/or recreation purposes by local governments; helps to implement conservation, recreation, open space, and coastal elements of local comprehensive	Source/Contact: Florida Department of Community Affairs, Communities Trust

Table 13-5. Potential Funding for Mitigation

Program	Fund Source Contact
plans. The Board of Florida Communities Trust has latitude to consider innovative financing arrangement, loans, and land swaps. However, most of the Trust's funding is for land acquisition. Land acquisition projects in which matching funds are available will receive more favorable consideration, although a portion of available funds may be awarded as outright grants.	
Community Development Block Grants/Entitlement Grants To develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low to moderate income individuals.	Source: HUD Contact: Office of Block Grant Assistance
Community Development Block Grants/State Program To develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low to moderate income individuals.	Source: HUD Contact: Small Cities Division, Office of Block Grant Assistance
Economic Injury Disaster Loans (EIDL) To assist business concerns suffering economic injury as a result of certain presidential, Secretary of Agriculture, and/or Small Business Administration declared disasters.	Source: SBA Contact: Office of Disaster Assistance
Emergency Shelter Grants Program (ESG) To provide financial assistance to renovate or convert buildings for use as emergency shelters for the homeless. Grant funds may also be used to operate the shelter (excluding staff) and pay for certain support services.	Source/Contact: Florida Housing & Urban Development; Community Planning & Development
Physical Disaster Loans (Business) To provide loans to businesses affected by declared physical type disasters for uninsured losses; may include costs to mitigate future damage.	Source: SBA Contact: Office of Disaster Assistance
Post-Disaster Public Assistance Program To provide supplemental assistance to States, local governments, and certain private nonprofit organizations to alleviate suffering and hardship resulting from major disasters or emergencies declared by the President. Costs for feasible and cost-effective mitigation can be included.	Source: FEMA Contact: DCA
Flood Plain Management Services To promote appropriate recognition of flood hazards in land and water use planning and development through the provision of flood and flood plain related data, technical services (such as floodproofing evaluations of public buildings), and guidance.	Source: U.S. Army Corps of Engineers Contact: Jacksonville District

Chapter 14: Evaluation, Updates & Revisions

14.1 Distribution

Upon adoption, the LMS will be posted on the Monroe County Office of Emergency Management's web site and notices of its availability will be distributed to the federal and state agencies that were notified and the organizations, agencies, and elected officials who received notices of public meetings.

14.2 Annual Evaluation & Updates

As required by State statute (Chapter 9G-22) and to ensure that the Local Mitigation Strategy is current and continues to serve the interests of residents and visitors, the LMS Work Group will perform an evaluation and, if appropriate, prepare revisions every year. Minor revisions may be handled by addenda. Revisions are to be submitted to the Florida Department of Community Affairs no later than the last workday of each January.

The Monroe County Office of Emergency Management, the LMS Coordinator, will coordinate the review and preparation of revisions that may be identified. The participating Work Group members are responsible for recommending revisions pertinent to their jurisdiction or organization. Revisions may be appropriate due to:

- Hazard events that have occurred that prompt a change in the characterization of risk.
- Significant changes to the critical facilities list (addition or deletion of facilities).
- Changes to the NFIP's list of Repetitive Loss Properties (if the list is provided for this purpose).
- Changes in knowledge and understanding of the people and property that are at risk which may be reflected in hazard maps.
- Changes to the list of mitigation initiatives (addition of new initiatives, deletion or completion of previously-listed initiatives).
- Changes in department organization, regulations, comprehensive plans, and the like.
- Changes necessary to comply with State and federal program requirements.

The following schedule will be followed (subject to changes as a function of hazard events):

- By the end September of each year, the LMS Coordinator will notify Work Group members of the need to review the LMS and identify revisions; Work Group members will submit proposed revisions to Emergency Management which will be discussed at a Work Group meeting. Emergency Management will compile the proposed revisions and, with Work Group approval, will

forward the revisions to the Department of Community Affairs by the last working weekday of January.

- On a quarterly basis the Work Group will accept new initiatives to be placed on the list of Preliminary Identified Mitigation Initiatives.

14.3 Five-Year Revision

A comprehensive review of and revisions to the LMS will be conducted on a five-year cycle. In part, this revision will be to incorporate the material collected for the annual updates. Because the LMS is adopted in 2005, it will enter the next evaluation and review cycle sometime in 2009, with adoption and publication anticipated in 2010.

The Monroe County LMS Work Group will involve the public in the LMS revision process in the same manner used during the 2005 revision. The public will be notified when the revision process is started and provided the opportunity to review and comment on changes to the LMS. It is expected that a combination of informational public meetings, surveys and questionnaires, draft documents posted on the web site, and/or public Council meetings may be undertaken.

14.4 Incorporating Mitigation Plan Requirements into Other Local Planning Mechanisms

Chapters 7 through 12 describe how Monroe County and the cities of Key West, Marathon, Key Colony Beach, Layton, Islamorada and address hazards as part of their current planning mechanisms and processes, including comprehensive plans, land development, infrastructure design, and public outreach. The 2005 revision of the LMS did not reveal any significant gaps in how hazards are addressed in existing planning mechanisms and processes.

Many mitigation initiatives are capital projects. When those initiatives are prioritized and funding is sought, each jurisdiction will comply with its existing rules regarding inclusion of projects in its Capital Improvement Plan or other budget and planning document or process.

Appendix A: Public and Critical Facilities

The database of public and critical facilities, including certain facilities owned by private non-profit organizations, will contain the following fields. Each jurisdiction and entity is responsible for preparing the data to the level that it deems appropriate. At a minimum, the "Owner" and "Location" fields will be completed.

Data Field		Description of Data Requested (complete as much as possible)
OWNER	Name	Name of entity that owns the facility
	Owner's Number	If you have an internal numbering system, use it; otherwise create a numbering system, e.g., KCB01 might be Key Colony Beach's city hall.
	Name of Facility	Common name, e.g., City Hall, Public Works Shop
	Rating (C/I/S/Other)	C = Critical; I = Important; S = Standard; O = Other
LOCA-TION	Address (street/city)	
	GPS/Lat-Long	Input physical location determined using GPS or Latitude and Longitude
FACILITY DATA	Primary Use (describe)	Brief description, e.g., offices, workshop/storage, residential, fire station, etc.
	Date of construction	Original construction (and date of any major addition or renovation)
	Number of stories	
	Describe type of construction	Examples: concrete frame with unreinforced masonry infill walls; wood frame on pilings
	Gross area (sf)	Estimate or obtain from insurance documents
	Building value/valuation date/basis	Note basis of the valuation, e.g., whether it is the replacement cost, market value, assessed value. Note date of the valuation. Best source may be insurance policy.
	Contents value/valuation date/basis	Note basis of valuation, e.g., whether it is the value used for insurance purposes or replacement cost. Note the date of the valuation.
WIND HAZARD	Existing Protection: Windows/Doors	Briefly describe if the building has any measures for wind protection, e.g., "built to meet Building Code" or "hurricane shutters installed in 1999." State if no protection. If the existing protection is a retrofit measure that was funded with FEMA/DCA funds, be sure to complete the "Mitigation Initiative Number" field.
	Existing Protection: Mechanicals	Briefly describe exposed mechanical service equipment, e.g., "this building has no rooftop equipment" or "rooftop equipment built to meet Building Code" or "two HVAC units on roof but not know if existing anchoring is adequate".
	Past Events (date, describe damage/cost to repair or damage avoided)	Note if affected by multiple events; describe at least the most recent.
	Mitigation Needs	Describe identified or likely mitigation measures; need not be detailed or based on rigorous analysis.
	Mitigation Initiative Number (if applicable)	This is a cross-reference number with the Mitigation Initiatives Spreadsheet.

Data Field		Description of Data Requested (complete as much as possible)
FLOOD HAZARD	FIRM Panel #, Zone & Base Flood Elevation	Could also insert predicted storm surge elevations (which often exceed the BFE shown on the Flood Maps).
	Existing Protection (describe elevation, foundation type)	Briefly describe, e.g., “partially elevated on crawlspace” or “slab-on-grade 6” above ground” or “elevated 1-foot above BFE on columns” etc.
	Past Event (date, describe damage avoided or actual damage and cost to repair)	Note if affected by multiple events; describe at least the most recent.
	Mitigation Needs	Describe identified or likely mitigation measures; need not be detailed or based on rigorous analysis.
	Mitigation Initiative Number (if applicable)	Note if (a) not adequately protected (if applicable, identify proposed project #); or (b) mitigation has been done (identify completed project #, describe measures, indicate year, source of funds, and project cost)

Appendix B: Resolutions of Adoption

[XX this will contain full sized scans of all of the resolutions of adoption

Appendix C: Mitigation Initiatives – Tracking Spreadsheet

[XX *The following is a first draft of fields for the database to track initiatives (not yet reviewed by the LMS WG)*

PRELIMINARY MITIGATION INITIATIVES
1. Name of owner/entity;
2. Name project/building (and location/address)
3. Brief description of project and need and the hazard and problem(s) it would address; and
4. Rough cost estimate based on the best available information, including a description of how the estimate was made.
5. Date submitted for Preliminary list
6. Date confirmed to remain on the Preliminary list

PRIORITIZED MITIGATION INITIATIVES
1. Name of owner/entity
2. Point of contact responsible for providing the detailed information;
3. Name of project/building (and location/address)
4. Detailed description of project (scope of work) and need, and the hazard and problem(s) it would address;
5. Explanation of how the initiative satisfies the Mitigation Goals (see Section 4.2);
6. Number and description of the population served;
7. Project costs and a description of how those costs were estimated;
8. Description of project benefits, including how benefits can be quantified;
9. Description of economic, social, and environmental benefits;
10. Estimate of period of time the project is expect to take to complete; and
11. A statement regarding availability of the non-federal cost share.

INITIATIVES THAT ARE COMPLETED OR REMOVED
1. Name of owner/entity
2. Name of project/building (and location/address)
3. Brief description of the project
4. Date completed
5. Source of funds
6. Date removed from further consideration
7. Reason for removal

Appendix D: Submission and Prioritization of Initiatives

[XX *pending completion of WG action outlined in Sec. 13.3. This appendix will contain the form used to submit initiatives for the Preliminary list, the form used to submit more detailed information in order to be prioritized, and the form used to submit information on completed initiatives or to request that an initiative be "removed" from the list.*